ELECTRICAL CONSTRUCTION AND MAINTENANCE

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SEPTEMBER · 1949

Planned Lighting Systems

How to appraise and select equipment and components for modern lighting application.

and beginning

Reader Service...

a new and expanded department brings you direct information on new products, current trade literature, code and technical questions.

A McGRAW-HILL PUBLICATION

Why it pays to pick the fixture with a better ballast!

Quality ballasts are not only essential to complete satisfaction with fluorescent lighting—they save money for the buyer, too! Ballasts of superior design and materials assure you of full rated light output; you actually need *fewer fixtures* for your lighting job. Quality ballasts last longer and make lamps last longer; this means *lower maintenance costs.*

General Electric builds quality ballasts—ballasts that, over a 10-year period, can save you as much as 32 per cent of your initial outlay for lighting. So remember to look for the G-E ballast tag when you're buying fluorescent fixtures—and get the most out of your investment.

Send today for your free copy of G.E.'s new booklet "Quality Costs Less"—it shows with facts and figures how good ballasts mean economy for you. Address Sec. *412-80, Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

ADVERTISED IN TIME THE WEEKLY NEWSMAGAZINE

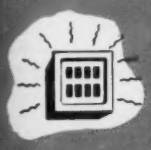
GENERAL ELECTRIC

412-80

Why Use HEAT To Interrupt verload CURRENT?

...at and Current Are NOT the Same...

Heat Builds Up In



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WARM ROOMS

DIRECT SUNLIGHT

Murray

FULLY MAGNETIC Circuit Breakers

are **NOT** Affected by Heat

Because they have

NO Thermal Element!

By using the *magnetic field*, which surrounds every current carrying conductor, Murray engineers have perfected a circuit breaker that assures dependable protection combined with freedom from temperature influences. Inverse time delay is effected by a simple, hermetically sealed, factory calibrated hydraulic piston.

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Why be satisfied with breakers having erratically operating thermal elements . . . with breakers that often cannot even carry rated loads continuously . . . with breakers that must be "derated" in an attempt to prevent false tripping? Insist on Murray *Fully Magnetic* Circuit Breakers — the breaker that is independent of temperature because it has *No Thermal Element!*

Listed by Underwriters' Laboratories, Inc.

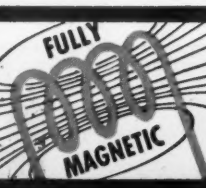
Murray *Fully Magnetic* Breakers are available in 2, 4, or 8 breaker load centers. Each breaker can be *individually* replaced with breaker of same, lower or higher rating.

Single pole breakers in 10, 15, 20, 25, 30, 35 and 50 amp. ratings. Only two handle positions — Off and On.

Get the full facts on Murray *Fully Magnetic* Circuit Breakers. Operating characteristics and construction features are given in this informative folder. Write for your copy now.

R TOMORROW'S LOADS . . .

Equip Today!



Murray

MANUFACTURING CORPORATION

50 Years of Service to the Electrical Industry

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SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS

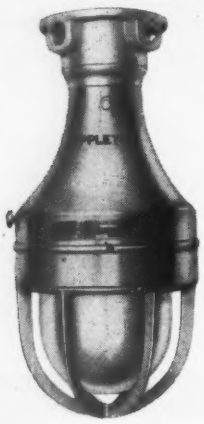
MORE FOR EVE
LIGHTING DOLLA

Industrialite High Mounting Fixture

For use in railroad yards and round houses, steel mills, foundries—hundreds of industrial installations.

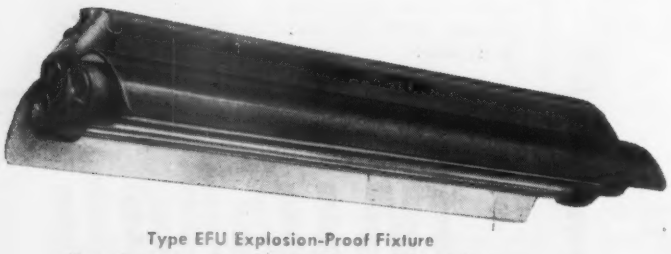
Diffuso Floodlight

For even illumination of service stations, athletic fields, tennis courts, parking spaces, etc. Available for Pole, Bracket or Cross arm mounting.



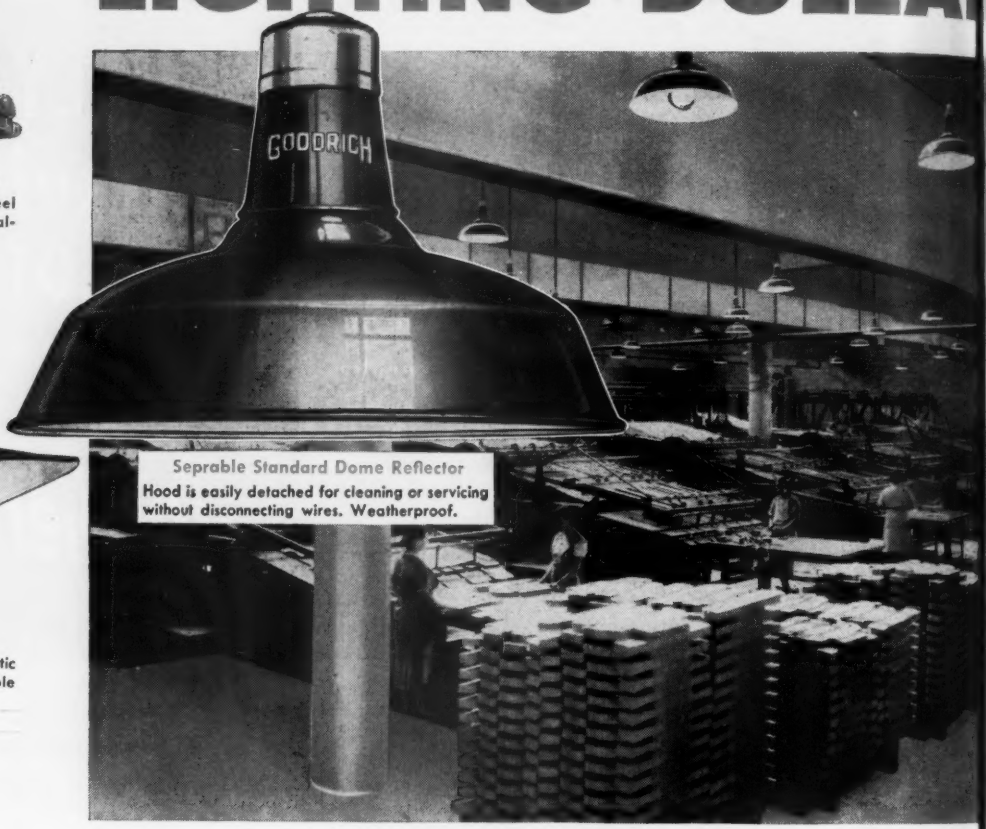
Type EVX Explosion-Proof Fixture

Ruggedly built of tough, malleable Iron, this Fixture provides safe, superior illumination for hazardous locations.



Type EFU Explosion-Proof Fixture

Up-to-the-minute version of the first Fluorescent Lighting Fixture ever to be developed. Can be hung horizontally or at 45-degree angle.



Seprable Standard Dome Reflector

Hood is easily detached for cleaning or servicing without disconnecting wires. Weatherproof.

APPLETON LIGHTING EQUIPM

Appleton Lighting Equipment is scientifically designed to provide maximum lighting efficiency at minimum installation, service and operating expense.

The manufacture of Appleton Fixtures is quality controlled from raw materials to finished product. Metal parts of reflector are made of pure ingot iron—tough, long-wearing metal that is ruggedly corrosion-resistant. Vitreous-fired porcelain enamel finish provides mum reflecting efficiency.

Including hundreds of types and the Appleton Line contains a fix fit virtually every lighting requir whether indoors or out. Sectio construction of all types assures easy servicing. Get the most fro lighting dollar. Specify App STANDARD FOR BETTER LIGH

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With which is consolidated Electrical Contracting
The Electragist and Electrical Record ... *Established 1901*

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering installations, repairing, maintenance and management, in the field of electrical construction and maintenance.

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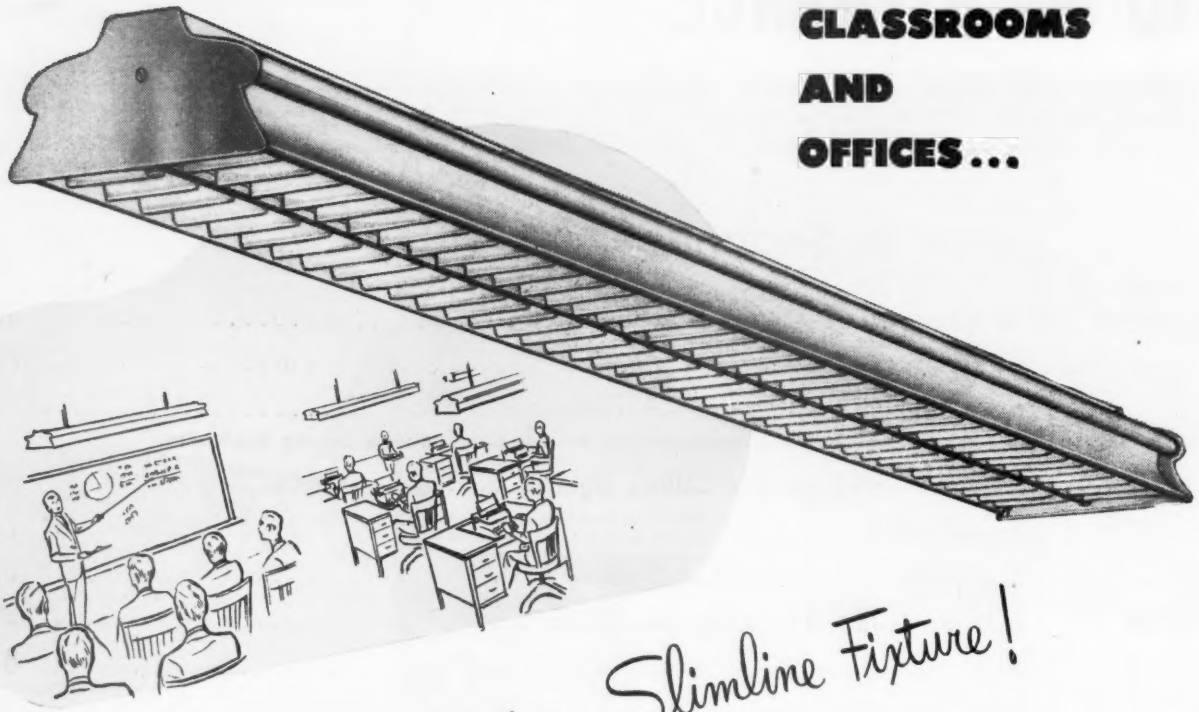
PUT THIS NEW *"Ocular Comfort"*

INTO CLASSROOMS AND OFFICES...

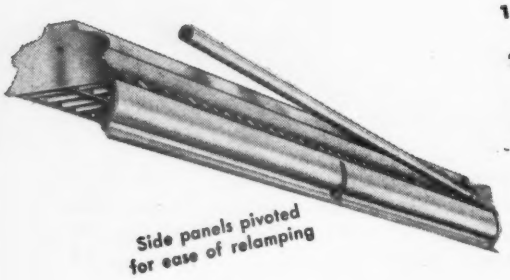


it's the latest Wheeler *Slimline Fixture!*

NOW you can get eight outstanding fixture features, all in one new Slimline Fixture. Wheeler's "Ocular Comfort" represents the accumulated design and engineering skill of almost 70 years in the specialized manufacture of lighting equipment. It meets a demand for:

1. **All metal construction** ... *no glass or plastics ... nothing to break or distort*
2. **Indirectly-illuminated side panels** *of smooth metal ... easily cleaned—no dirt-catching perforations*
3. **Low surface brightness**
4. **Pivoting side panels** ... *for ease of relamping (see illustration at left)*
5. **One-piece bottom louver** ... *never needs to be disturbed except for access to operating equipment*
6. **Better-than-average shielding** ... *35° both crosswise and lengthwise of fixture*

7-8. Pleasing appearance *plus high efficiency*



Side panels pivoted for ease of relamping

"Ocular Comfort" Slimline Fluorescent Fixtures are made for use with the 75 watt, 96" T12 Slimline lamp and the 40 watt 48" T12 single pin lamp. Both lamps instant-starting type. Lampholders—depressable type. Be sure to get all the details of this new product of Wheeler "Skilled Lighting". Write, *Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.* ... also New York, N. Y. Representatives in principal cities.

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Wheeler REFLECTORS

"SKILLED LIGHTING"

MADE BY SPECIALISTS IN LIGHTING EQUIPMENT SINCE 1881

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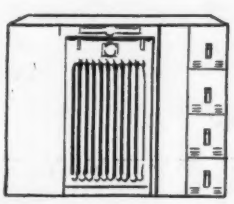
...grows with your load!

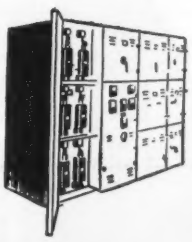
Standardized, self-enclosed starter units make building-on easy— As your system expands, these new motor-starting units can be replaced easily with larger ones because widths are uniform, heights proportionate. Complete new sections can be added alongside, or backed-up to, existing sections. Front-connected wiring and snap-on contacts make installation and servicing easy.

Development of this control center is yet another proof that General Electric keeps abreast of commercial-building needs with complete electric equipment for elevator, pump and blower drives—power distribution and conversion purposes. Your nearest G-E sales office will have an application engineer help you plan your entire system. Also, write for Bulletin GEA-4979, "New G-E Motor Control Center." ***Apparatus Dept., General Electric Co., Schenectady, N. Y.***

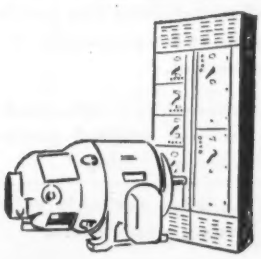
GE EQUIPMENT FOR COMMERCIAL BUILDING



Power-distribution Systems



Rectifiers for Power Conversion



Motors and Control

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Get your Free INDENTER

Cross Section Showing Indentations.

Here is your chance to get a *free* Briegel Indenter — the tool that saves more time installing thin wall tubing than anything else on the market. This Special Package Offer is made up of 400 1/2" Briegel Connectors and 200 1/2" Briegel Couplings — enough to wire three average six room houses — and One Original Briegel Indenter all for the price of the fittings alone.

The Briegel Method of installing thin wall is not only faster and less expensive but also neater in appearance and more permanent.

Cash in on this *free* offer while it lasts. Save time and save money on your original purchase and on the job with Briegel Fittings!

This offer available at all leading wholesalers.

All B-M Fittings Carry the Underwriters' Seal of Approval

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Insist on Briegel All-Steel Approved Couplings and Connectors. These are the Original Labor-Saving Indenter Type Fittings used by contractors for over 15 years.

BRIEGEL METHOD TOOL CO.

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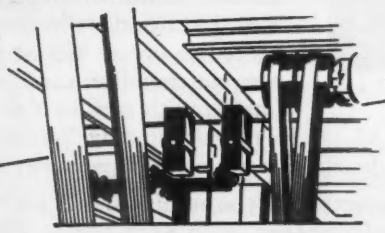
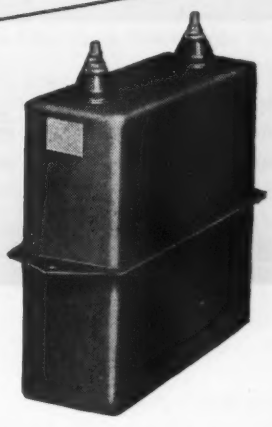




. . . that's what one Buffalo firm got when inexpensive G-E Capacitors raised its power factor from 65 per cent to 95.

Capacitors can do startling things to your power costs—if you have a power factor or kva demand clause in your power contract. Scores of firms, like The Russell Miller Milling Company of Buffalo, have realized returns of 50 per cent, and more, on their investment. Even in small plants, capacitors have produced savings of $5000 a year.

Even though you have no power factor clause in your power contract, G-E capacitors may effect real savings. If your plant feeder circuits are overloaded, capacitors can provide relief —a 30% increase in capacity is not unusual. If you are bothered by low voltage and slowing down machines, G-E capacitors may solve that too.

We strongly urge you to make sure that *your* plant is taking *full* advantage of capacitors. A G-E specialist will gladly cooperate with your engineering staff.

A NEW BOOKLET explains how capacitors work and gives specific data to show you what you may expect from them. Write today for Bulletin GEA-5167, Apparatus Dept., General Electric, Schenectady 5, N. Y.

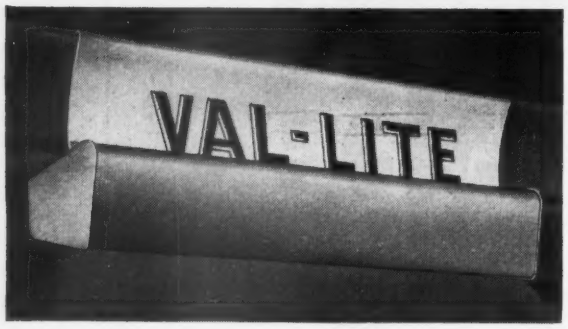
For other power distribution ideas that will save you money, ask your electric utility to show you the full-color slide-film, "Modern Industrial Power Distribution," or contact your G-E representative.

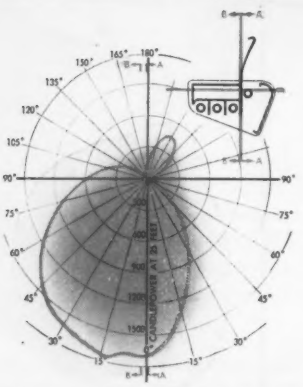
GENERAL ELECTRIC

407-181

...perfect lighting for modern merchandising!

KENT-MOORE VAL-LITES





Candlepower Distribution Chart for VAL-LITE Model J-1817 equipped with four 40-watt fluorescent lamps.

What a difference VAL-LITES make in modern retail store lighting! First, they're good looking fixtures . . . smartly styled as attractive "tailored" valances that provide radiant diffused illumination all around the wall sales area. Second, VAL-LITE'S distribution of candlepower has been engineered to create distinctively lighted displays that dramatize merchandise, catch and hold customer attention. And finally, with easy-to-change, easy-to-read individual letters, VAL-LITES permit effective "point-of-purchase" advertising and provide efficient means of department identification to direct store traffic.

So next time you're planning a retail store lighting system, emphasize *"sales appeal"* with Kent-Moore VAL-LITES. Quickly, easily installed in either single or multiple unit application. Available in models for two or four 40-watt fluorescent lamps. Sturdily built, union made, approved by Underwriters'. Write for complete details today.

Kent-Moore ORGANIZATION, INC.

GENERAL MOTORS BUILDING • DETROIT 2, MICHIGAN

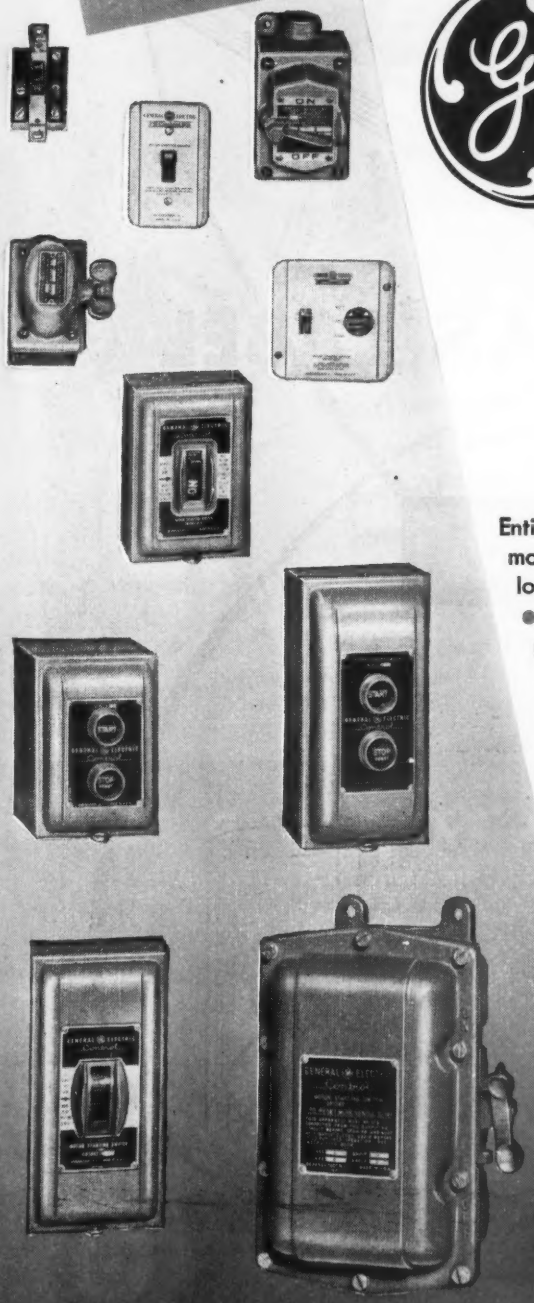
VAL-LITES BUILD SALES FOR YOU AND YOUR CUSTOMERS

Kent-Moore VAL-LITES are a "natural" for super markets. Merchandise sparkles, and customers can find it fast.

Brand names stand out against VAL-LITE backlighting while appliances below make a "buy-appealing" display.

This automobile dealer increased mechanic efficiency by lighting and labeling his service department car stalls.

more for your money



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- **new, improved features**
- **wider selection**

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- Bi-metallic overload protection—formerly found only in expensive equipment—provides quick, positive action, frequent resetting without wear. When relay trips, operating mechanism assumes neutral position, giving positive indication of overload trip.

All starters provide . . .

- heavy duty switch mechanism that resists vibration, stands up under frequent use . . . plenty of knockouts, lots of room in the sturdy grey case for wiring . . . dust tight, water tight, and explosion-proof as well as general purpose forms . . . and many other features described in the bulletins.

Whatever your requirements for small-motor starting, you'll find them met in G-E manual starters. Write now—buy now!

General Electric Company
Apparatus Dept., Section F730-8
Schenectady 5, N. Y.

Please send me: Bulletin GEA-2234E on the CR1061 Manual Starter for F-hp motors.....and (or) Bulletin GEA-1522E on the CR-1062 Manual Starter for Integral Motors.

Name .....

Company .....

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.....

GENERAL ELECTRIC

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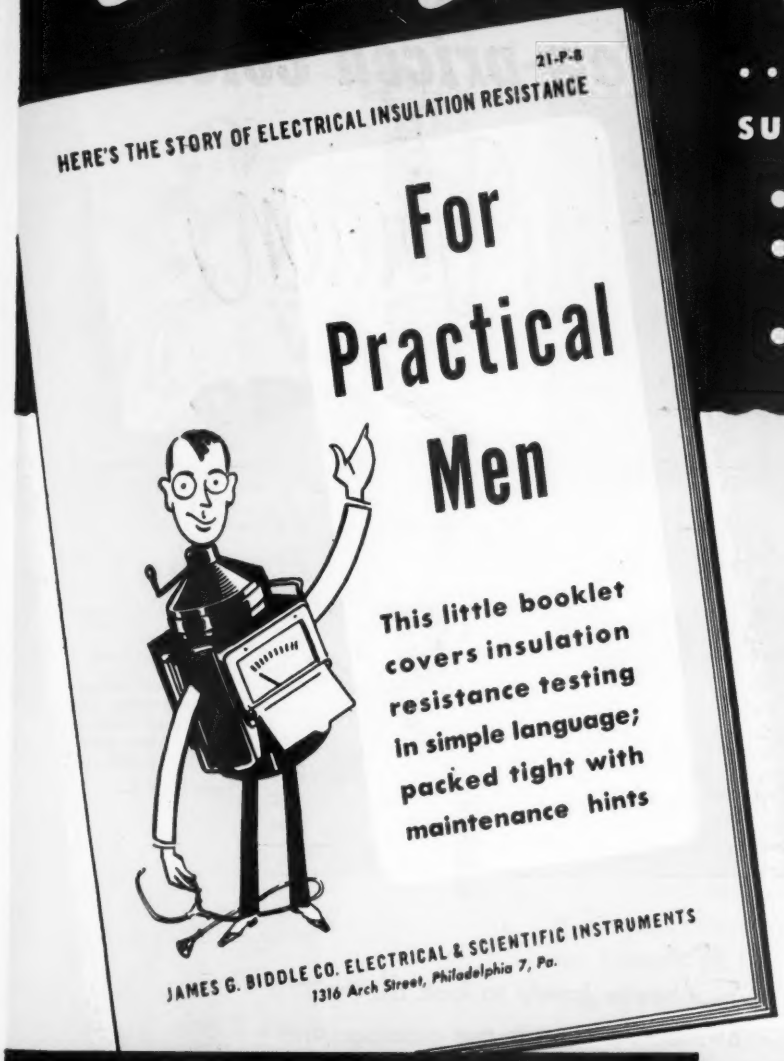
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HERE'S THE STORY OF ELECTRICAL INSULATION RESISTANCE
For Practical Men
This little booklet covers insulation resistance testing in simple language; packed tight with maintenance hints
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. . . offers practical suggestions on how to . . .

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- test insulation in electrical equipment
- reduce maintenance costs

Five minutes' reading time will give you a practical slant on the simplicity and yet highly efficient and profitable aspects of periodic testing of the insulation in your electrical equipment.

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What makes it go bad?
How to test it?
Is it worth it?

. . . and many others—answered simply and understandably. Simply fill in, clip and mail the coupon *NOW*, for your *free* copy of this valuable maintenance aid.

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by Virden

New. Appealing in design and price. ▶ Etched shades with cut decoration. Sparkling glass stem-ornament and pendant teardrop. Top flare pierced for extra teardrops if added sparkle desired. Metal is Colonial brass

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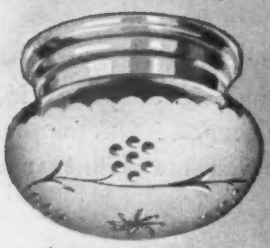
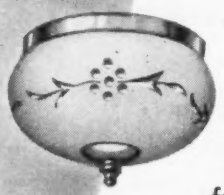
(18" spread)—5 light

No. V-2403
(14" spread)—3 light

◀ New and attractively priced. Cut glass and Colonial brass. Truly traditional. Extension 6"
No. V-2401



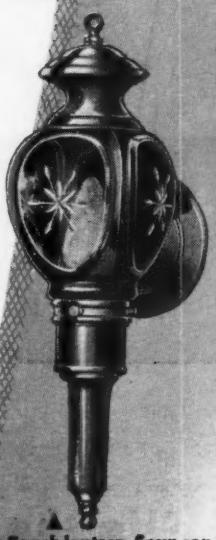
▲ Compact ceiling light. Lovely cut design in etched glass. Brass canopy. 7½" spread
No. V-2293



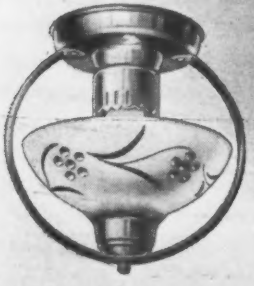
▶ A smaller unit in cut glass and Colonial brass. 5½" spread
No. V-292-C

They're lovely to look at. They're brand new—not in our catalog. And your customers will love the prices. For dining room, or living room they add that distinctive traditional touch. And thanks to Virden designing skill and mass production know-how, they offer extra value . . . Virden value.

Shown here also are related units from our catalog which fit other home needs. Ask your Virden wholesaler.



▲ Coach lantern. Spun copper, for outdoor use. Finished in black or brass. 16" depth.
No. V-973



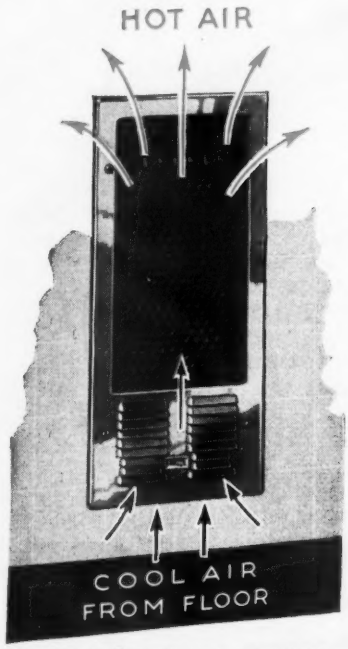
◀ Hall light. Colonial brass trim, etched bowl with cut design. 7" spread
No. V-2841

VIRDEN VALUE

John C. Virden Company · Cleveland, Ohio

When they need Comfort most

. . . it's there!



The Electric (FA) Quikheter features both radiant and convection heating principles. Cool, floor-level air is drawn up into the heater, warmed, and sent evenly throughout the room. The heater has a Nichrome heating element that doesn't burn out; nor are there any moving parts or fans to become faulty. Attractive polished chromium cover is easy to clean.

"ELECTRIC"
(FA) QUIKHETER

Your customers will thank you again and again for installing the Electric (FA) Quikheter in their new or remodeled homes.

The (FA) Quikheter quickly changes a cold, shivering bathroom into one that's cozy and warm . . . merely by flipping the switch —conveniently mounted in the unit—that starts a delightful flood of warm air.

Customers will like its long-lasting, dependable performance, since the absence of moving parts insures trouble-free operation for years and years. And they will also like its penny-pinching economy . . . for the (FA) Quikheter costs but a few cents per hour of continuous operation.

Make your customers happier by installing (FA) Quikheters in their homes . . . so that when they need comfort most, it's there!

For more information see your nearest (FA) Representative (he's listed in Sweet's), or write for Bulletin No. 1102.

FA TRADE MARK

Frank Adam Electric Co.

ST. LOUIS 13, MISSOURI

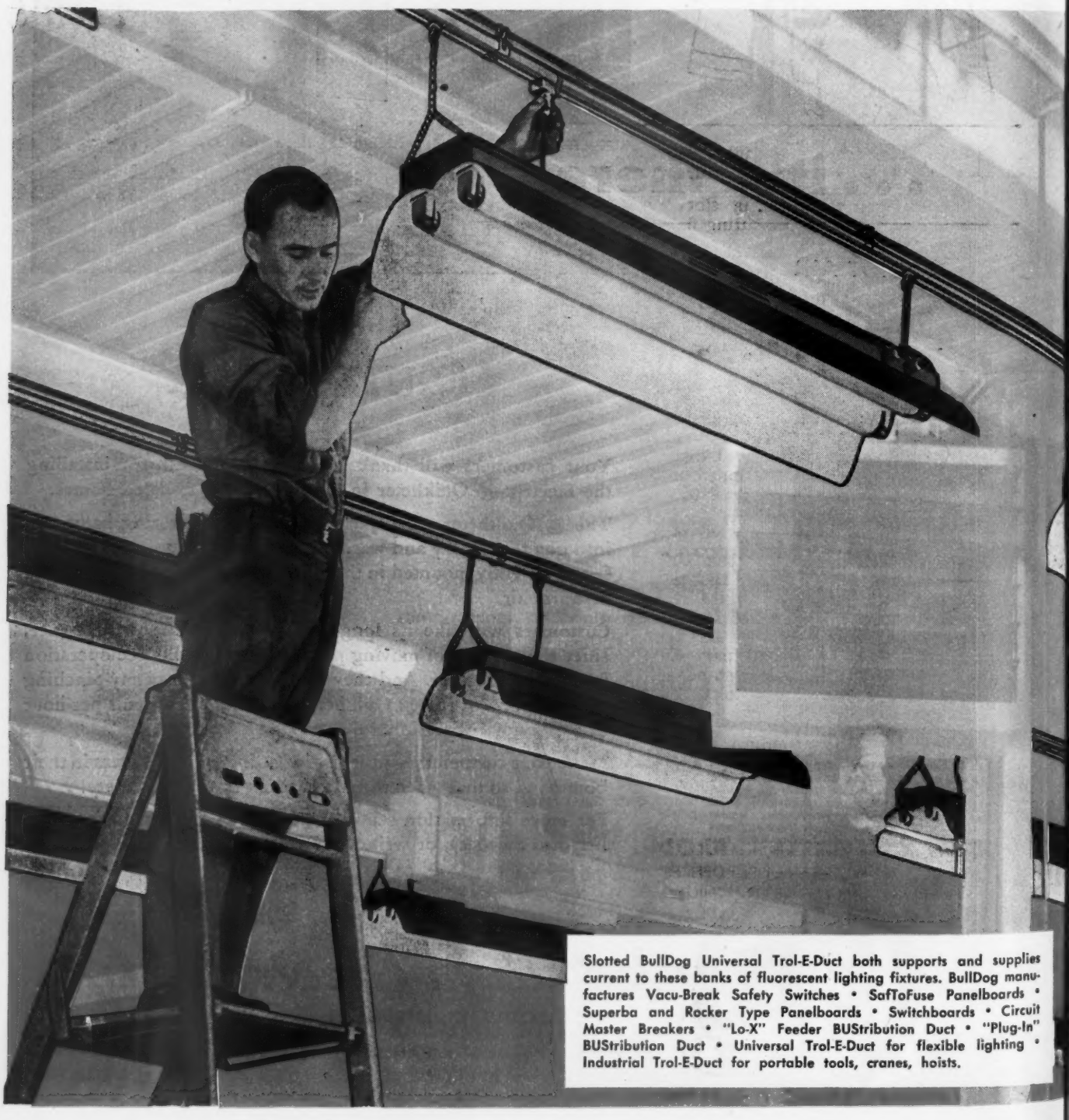
Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

ELECTRICAL CONTRACTORS

This message will also appear in a broad list of publications that are read by the men you seek to influence . . . your prospective customers.

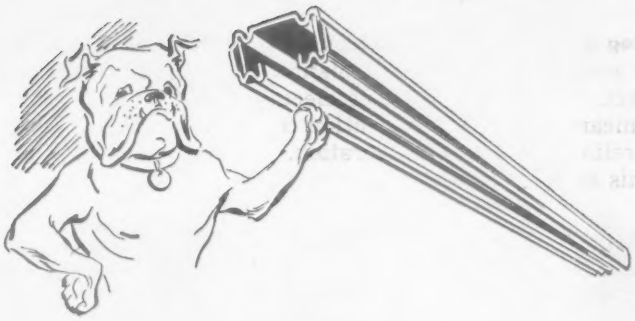
Spot your lighting w

BullDog Field Engineers welcome the opportunity to sit in with you during the early planning stages of a building project. Their knowledge of electrical distribution layout can mean savings in installation costs, as well as efficiency and reliability in actual operation. Why not take advantage of this service?



Slotted BullDog Universal Trol-E-Duct both supports and supplies current to these banks of fluorescent lighting fixtures. BullDog manufactures Vacu-Break Safety Switches • SafToFuse Panelboards • Superba and Rocker Type Panelboards • Switchboards • Circuit Master Breakers • "Lo-X" Feeder BUStribution Duct • "Plug-In" BUStribution Duct • Universal Trol-E-Duct for flexible lighting • Industrial Trol-E-Duct for portable tools, cranes, hoists.

with a slot



TIRED of rewiring the whole plant every time you have to move or add lighting fixtures?

Let the current-carrying *slot* in BullDog Universal Trol-E-Duct spot your lighting fixtures where and when you want them.

Takes changes in stride

BullDog Universal Trol-E-Duct gives you truly *flexible* lighting. Trol-E-Duct's continuous slot makes it possible for you to add, remove or change lighting fixtures at will . . . without rewiring.

Twist-out plugs or trolleys tap current from any point along the continuous slotted opening which runs the full length of the Trol-E-Duct. These devices can be instantly attached or removed without disconnecting the current. Twist-out plugs can be snapped on or off the duct at any point; trolleys roll along duct to furnish mobile outlets.

Entirely salvable

Prefabricated and standardized Universal Trol-E-Duct is comprised of durable steel sheathing enclosing solid copper bus bars. Made in lengths from one to ten feet, it readily supports weight of lighting fixtures and small tools. It can be dismantled and reinstalled at any time, without scrapping a single part. Existing systems can be easily expanded by adding standard sections and fittings. Capacity: 50 Amps., 250 Volts, Single Phase.

Call in a nearby BullDog Field Engineer for more information on this modern, efficient lighting system. He will be glad to show you a typical installation in your own neighborhood. Or, write for descriptive bulletin from BullDog direct.

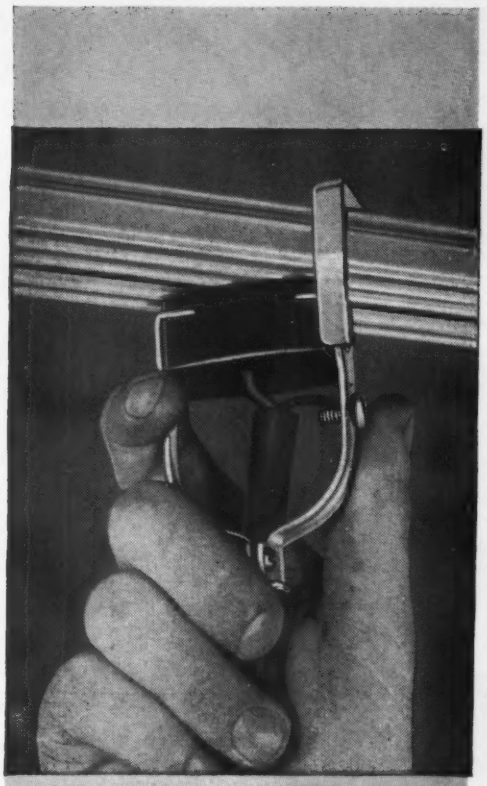
BULLDOG ELECTRIC PRODUCTS COMPANY

DETROIT 32, MICHIGAN—FIELD OFFICES IN ALL PRINCIPAL CITIES

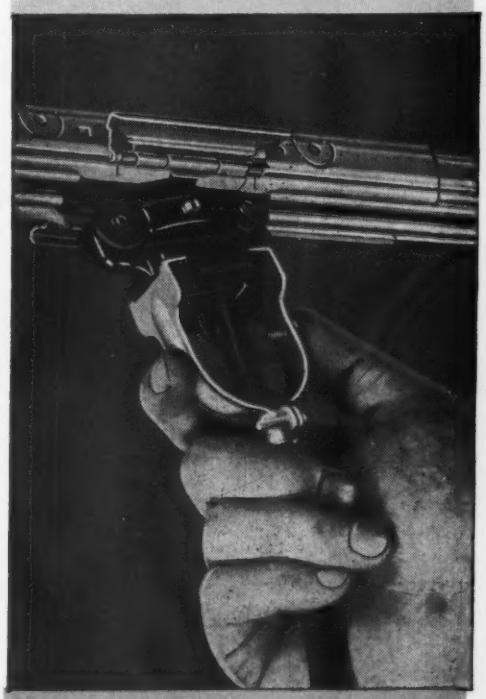
IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

BULLDOG

HEADQUARTERS FOR ELECTRICAL DISTRIBUTION



Inserting a twist-out plug in Universal Trol-E-Duct is easy! Simply insert plug contacts in slot of duct and give plug a quarter turn to lock firmly in place.



For a movable power source, use a trolley outlet, easily inserted at a Trolley Entrance Coupling. Metal wheels roll smoothly astride duct slot. Contacts are in constant touch with bus bars as trolley moves.

Royal Barry Wills, Boston, Mass., Architect

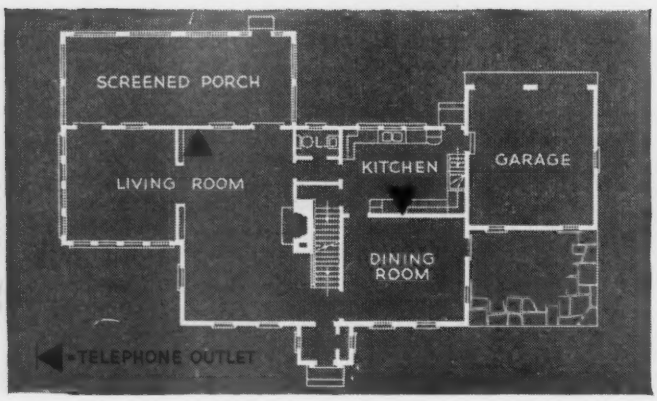
TELEPHONE RACEWAYS BECOME A NEW ENGLAND TRADITION

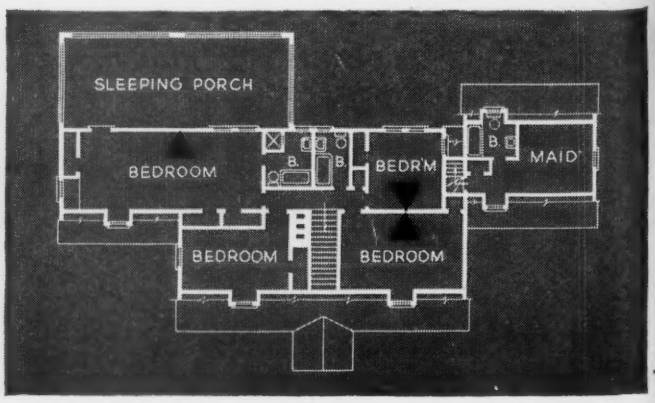
No one would think of designing or building a house today with electric wires and water pipes exposed. It's just as important to conceal telephone wires.

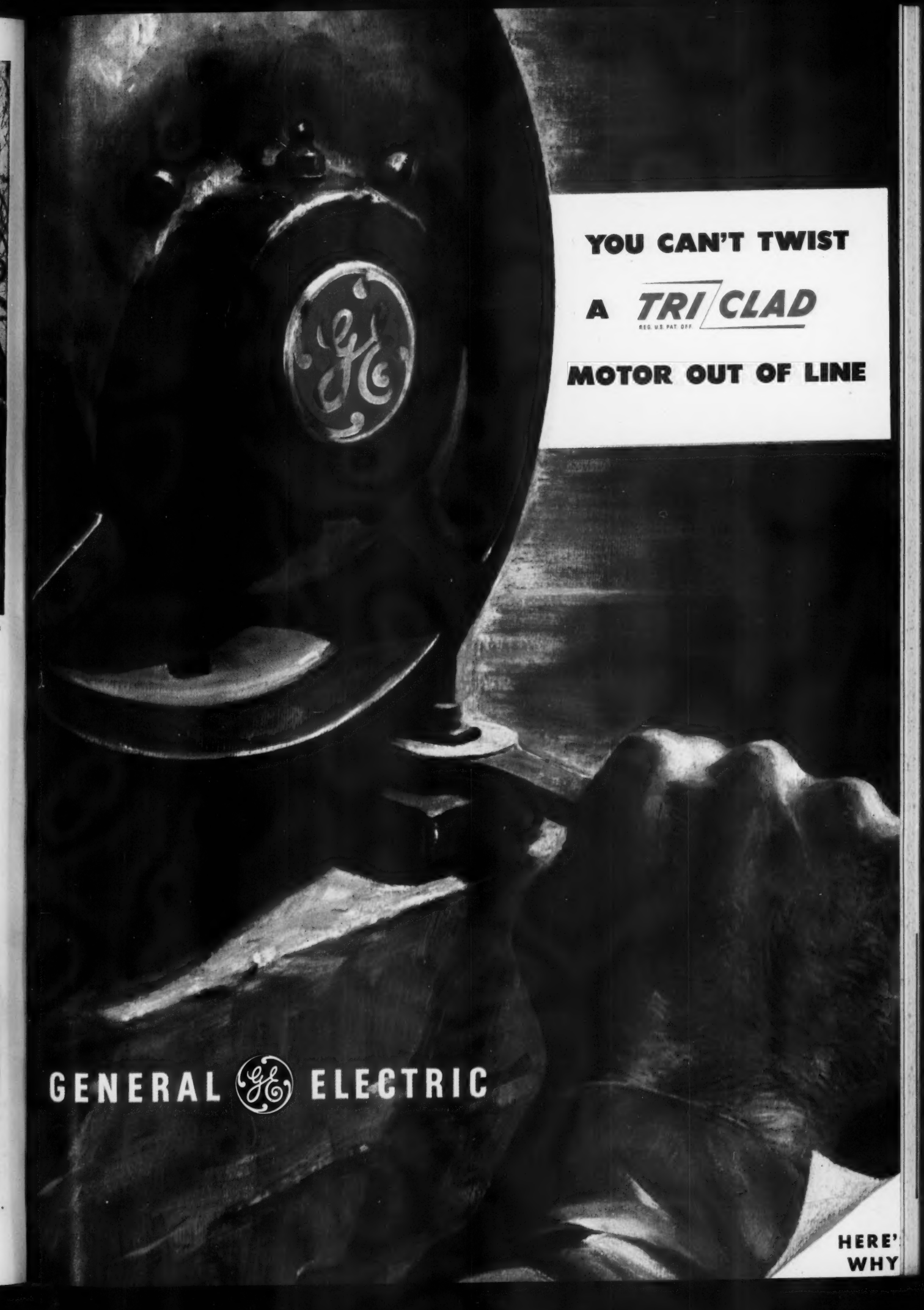
Telephone raceways are easily installed during construction. A few lengths of pipe or tubing will carry telephone wires inside the walls to neat, convenient telephone outlets. They help to protect the interior beauty when telephones are installed. And they mean extra profits for you.

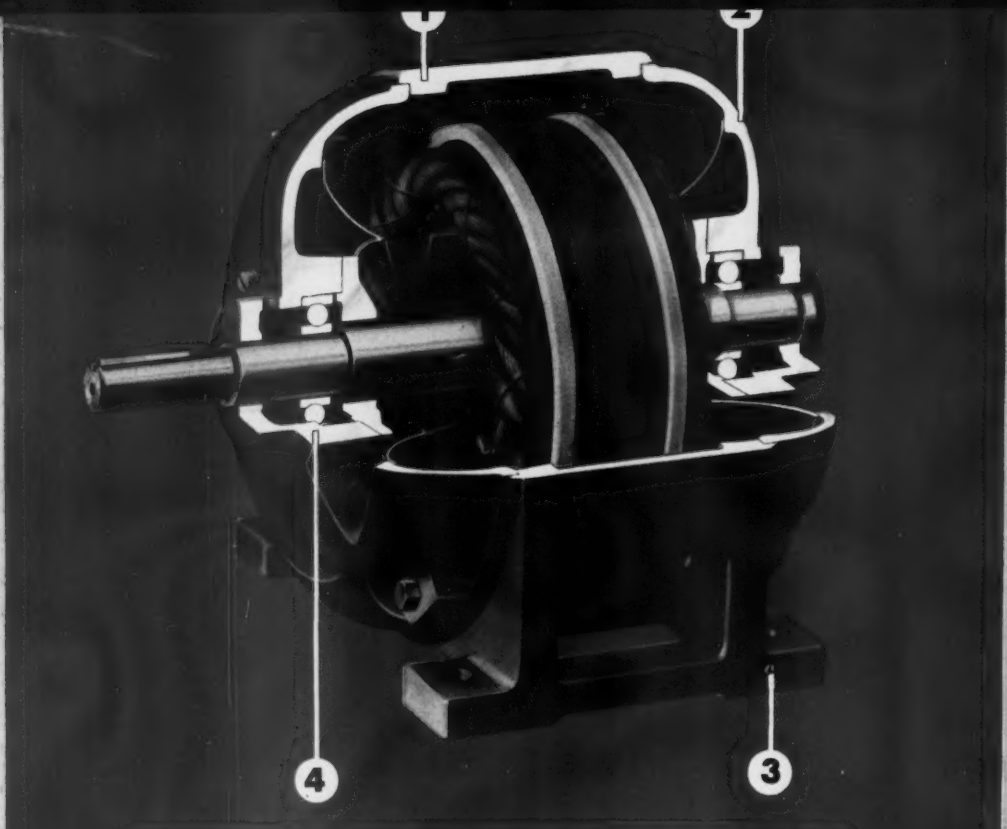
Remember—NO ELECTRICAL CONTRACT IS REALLY COMPLETE UNLESS IT INCLUDES RACEWAYS FOR TELEPHONE WIRES.

BELL TELEPHONE SYSTEM






YOU CAN'T TWIST
A TRI CLAD
REG. U.S. PAT. OFF.
MOTOR OUT OF LINE
GENERAL ELECTRIC
HERE'
WHY



Look at the solidity of a Tri-Clad's thick-section cast-iron frame (1) and heavily reinforced end shields (2) . . . its heavy integrally cast feet (3). Do you wonder we say "Tri-Clad gives you structural strength and rigidity no other general purpose motor can match"? Notice, too, the *completely enclosed* bearings (4). A Tri-Clad motor will run safely without relubrication for years — as long as any general-purpose motor you can buy. Yet it's grease-gun easy to lubricate if you ever need to.

You can't twist a TRI CLAD motor out of line

Try as a heavy-muscled mechanic may, he can't twist a Tri-Clad motor frame when bolting it to an uneven surface. The bolt will snap before he can pull that rigid cast-iron structure out of line.

Important? It's one of the basic reasons General Electric believes cast iron to be the ideal structure for general-purpose industrial motors. Other reasons? Cast iron has unusually high resistance to rust and corrosion. It has an inherent damping action that minimizes resonance. And . . . it won't take on an injurious permanent "set" as a result of accidental blows or mechanical abuse.

Want a motor that's been **SERVICE-PROVED** in 5 billion hours of rugged industrial use? Nearly all types and ratings are **AVAILABLE FROM STOCK.**

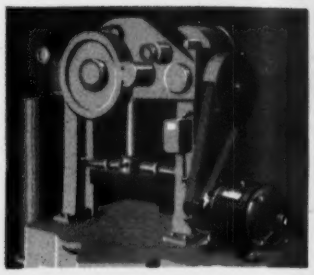
Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

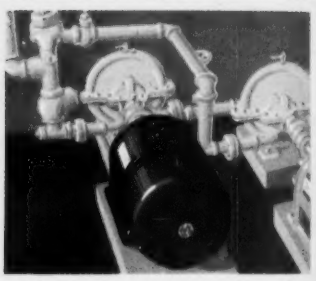
YOU CAN'T BEAT TRI CLAD

REG. U.S. PAT. OFF.

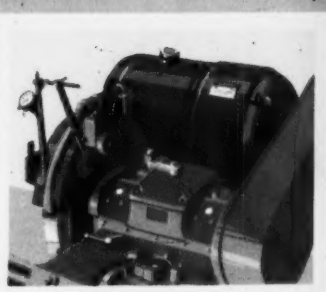
EXTRA PROTECTION



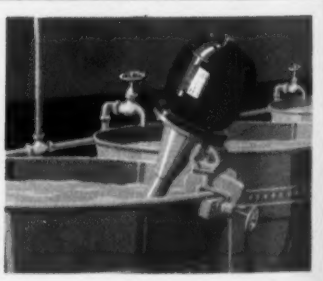
G-E open (drippreof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.



G-E totally enclosed motors for outdoor operation, in abrasive dusts, or corrosive fumes. From 1 to 1000 hp.



G-E Type ACA induction motors for adjustable speeds—provide 3 to 1 speed range. From 3 to 75 hp.



G-E flange and face-type motors for use where the machine supports the motor, or vice versa. From 1/20 to 60 hp.

Look for this **EXTRA** on the motor you buy!

Leader LEADS AGAIN!

● Now [illegible] engineers offer the NEW [illegible] Fluorescent Fixture jam-packed with light—brilliance without precedent! [illegible] larger diameter lamps, of 425 milliamperes, achieve a new high in intense illumination without any increase in surface brilliance.

When you seek the best in fixtures—[illegible]LEADER . . . When you want the latest in lighting progress—choose [illegible]ER . . . When you are looking for the most for your dollars—choose LEADER! [illegible]DER Fluorescent Fixtures—sold and [illegible] installed only by the better electrical wholesalers and contractors.

Send for mechanical details—today!

LEADER ELECTRIC COMPANY

3500 [illegible] KEDZIE AVE. • CHICAGO 18, ILLINOIS

[illegible] FACTORY • 2040 LIVINGSTON • OAKLAND 6, CALIFORNIA

ON and ON and UP and UP!

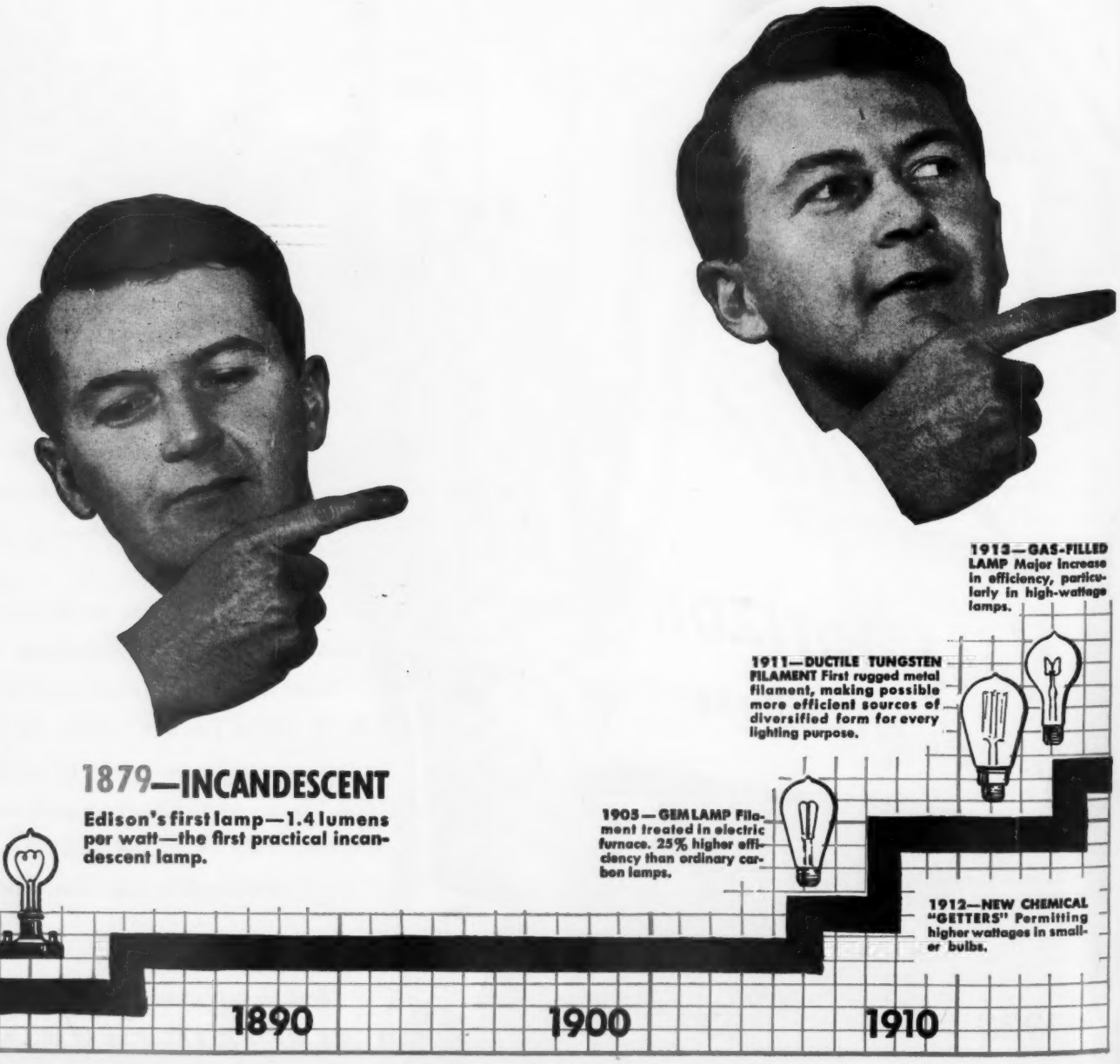
EVER since the development of Thomas Edison's first practical incandescent lamp 70 years ago, General Electric Lamp research has been constantly at work to make lamp bulbs better.

This graph tells the story.

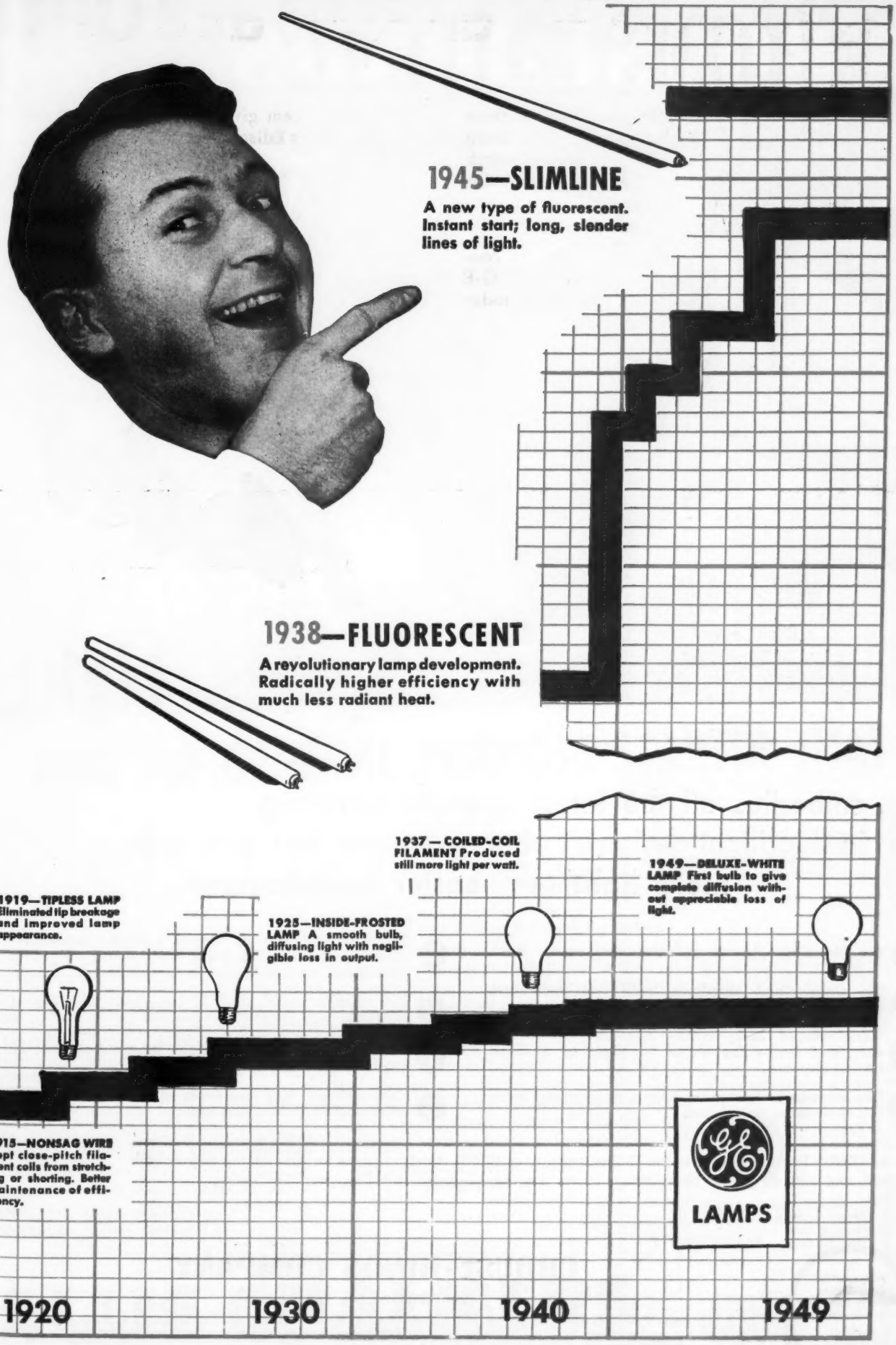
As General Electric Lamp research has continued steadily onward, the efficiency of G-E lamps has gone steadily upward, until today slimline fluorescent gives 50 times as much the light per watt as Edison's lamp of 1879.

Through giving customers greater and greater lighting value, General Electric has helped increase the use of better lighting everywhere. And an important assurance of ever-growing lighting business for you is the General Electric Lamp research which is always at work to make G-E lamps *STAY BRIGHTER LONGER!*

GENERAL ELECTRIC


1879—INCANDESCENT
Edison's first lamp—1.4 lumens per watt—the first practical incandescent lamp.
1903—GEM LAMP Filament treated in electric furnace. 25% higher efficiency than ordinary carbon lamps.
1911—DUCTILE TUNGSTEN FILAMENT First rugged metal filament, making possible more efficient sources of diversified form for every lighting purpose.
1912—NEW CHEMICAL "GETTERS" Permitting higher wattages in smaller bulbs.
1913—GAS-FILLED LAMP Major increase in efficiency, particularly in high-wattage lamps.
1890
1900
1910

Lighting's share of total electrical energy used


1945—SLIMLINE
A new type of fluorescent. Instant start; long, slender lines of light.
1938—FLUORESCENT
A revolutionary lamp development. Radically higher efficiency with much less radiant heat.
1937—COILED-COIL FILAMENT Produced still more light per watt.
1949—DELUXE-WHITE LAMP First bulb to give complete diffusion without appreciable loss of light.
1919—TIPLESS LAMP Eliminated tip breakage and improved lamp appearance.
1925—INSIDE-FROSTED LAMP A smooth bulb, diffusing light with negligible loss in output.
1915—NONSAG WIRE Kept close-pitch filament coils from stretching or shorting. Better maintenance of efficiency.
LAMPS
1920
1930
1940
1949
LUMENS PER WATT

increased from 24% to 30% between 1936 and 1946

CROUSE-HINDS

Crouse-Hinds
1950 Model
Sports Light
. . . Type FLA

1950 Model

Sports Light

. . . embodies all the latest scientific advances in floodlight design . . . improvements that give you more light and easier maintenance

1. The two-piece *Alzak reflector gives more light.
2. The stream-lined aluminum head and body give greater strength.
3. The hinged body makes relamping quick and easy and keeps the entire floodlight in a single unit at all times.
4. The extra large opening insures a quicker and better job of cleaning the interior.
5. The floodlight can be tipped over for convenient cleaning of the cover glass, and when returned to its original position, a stop insures perfect alignment.
6. The spun-in cover glass is both heat and impact resisting.
7. Degree markings and a sight for accurate aiming save installation time.
8. Crouse-Hinds' high standards of quality and skilful workmanship insure long life.

Crouse-Hinds' latest sports lighting bulletin contains NEMA standard plans for the lighting of baseball, football, and softball fields. Many minor sports are also included. Send for your copy today.

Alzak is the registered trade mark of the Aluminum Company of America

A Nationwide Distribution Through Electrical Wholesalers

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Syracuse 1, N. Y.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City
Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle
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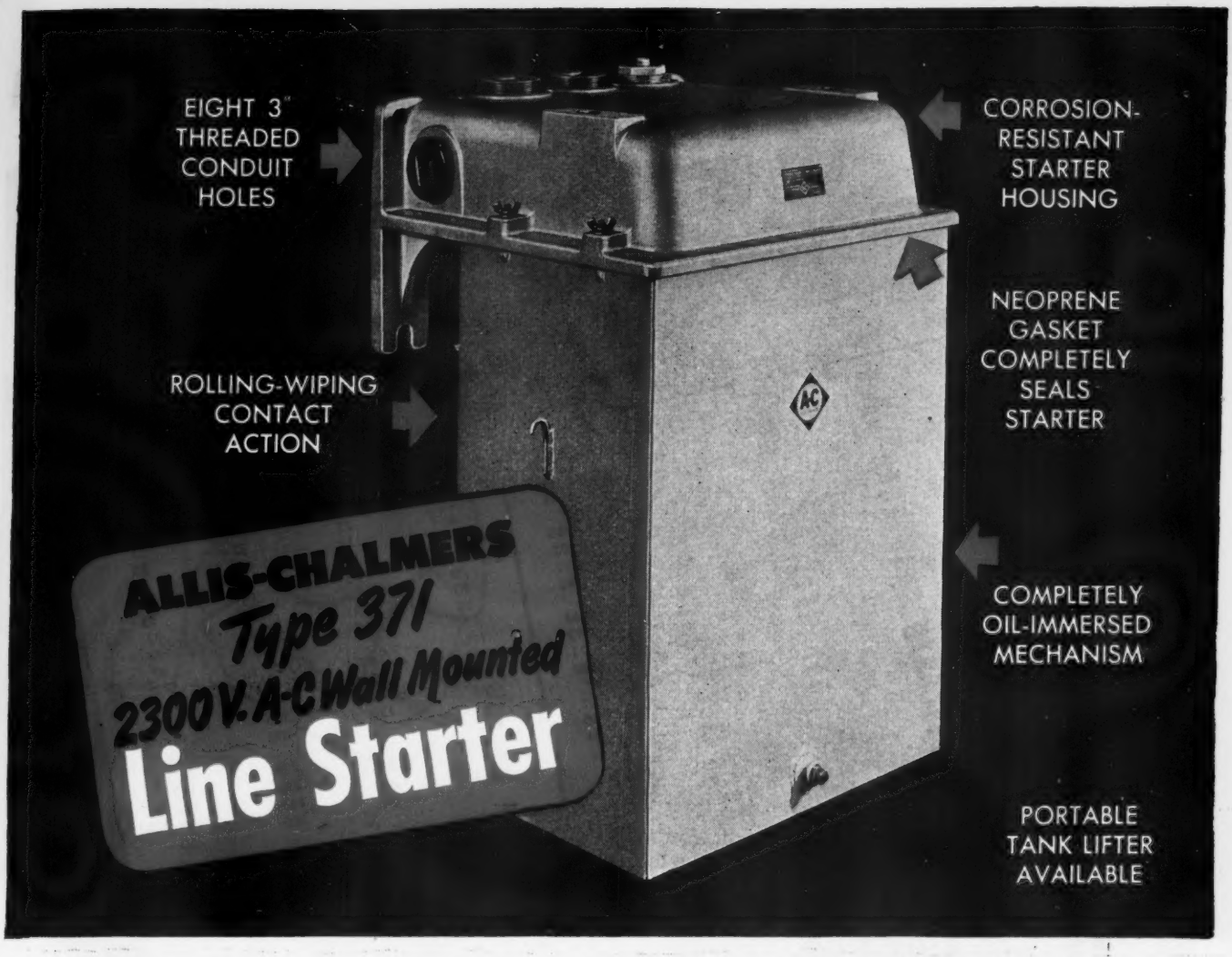
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

FLOODLIGHTS • AIRPORT LIGHTING • TRAFFIC SIGNALS • CONDULETS



HERE'S A *GENERAL PURPOSE* STARTER THAT

Beats Corrosion & Dust!

In chemical, liquid fuel, milling, coal handling — any industry faced with corrosive vapors or combustible dust laden atmosphere — Type 371 General Purpose Starters will give unfailing start-stop service, and complete protection! The wall mounted design permits low original cost — economical, space saving installation.

Check these features:

Corrosion Resistant — Aluminum alloy head casting, stainless steel hardware, aluminum painted tank mean corrosion resistant enclosure.

Completely Sealed — Tank is sealed to head with neoprene gasket : . . starter is impervious to dust, corrosive atmospheres.

Weatherproof — Can be used for outdoor installations.

Compact — Small enough to be located conveniently near motor being controlled.

In addition you get *rolling-wiping* contact action . . . low inertia moving parts . . . automatic reset temperature overload relays and other features that add up to minimum oil deterioration, increased contact life! They permit longer use without maintenance. Call your nearby A-C sales representative or write for bulletin 14B7274.

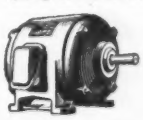
ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

A-2807

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

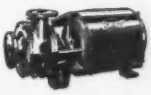
Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



MOTORS — ½ to 25,000 hp and up. All types.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.



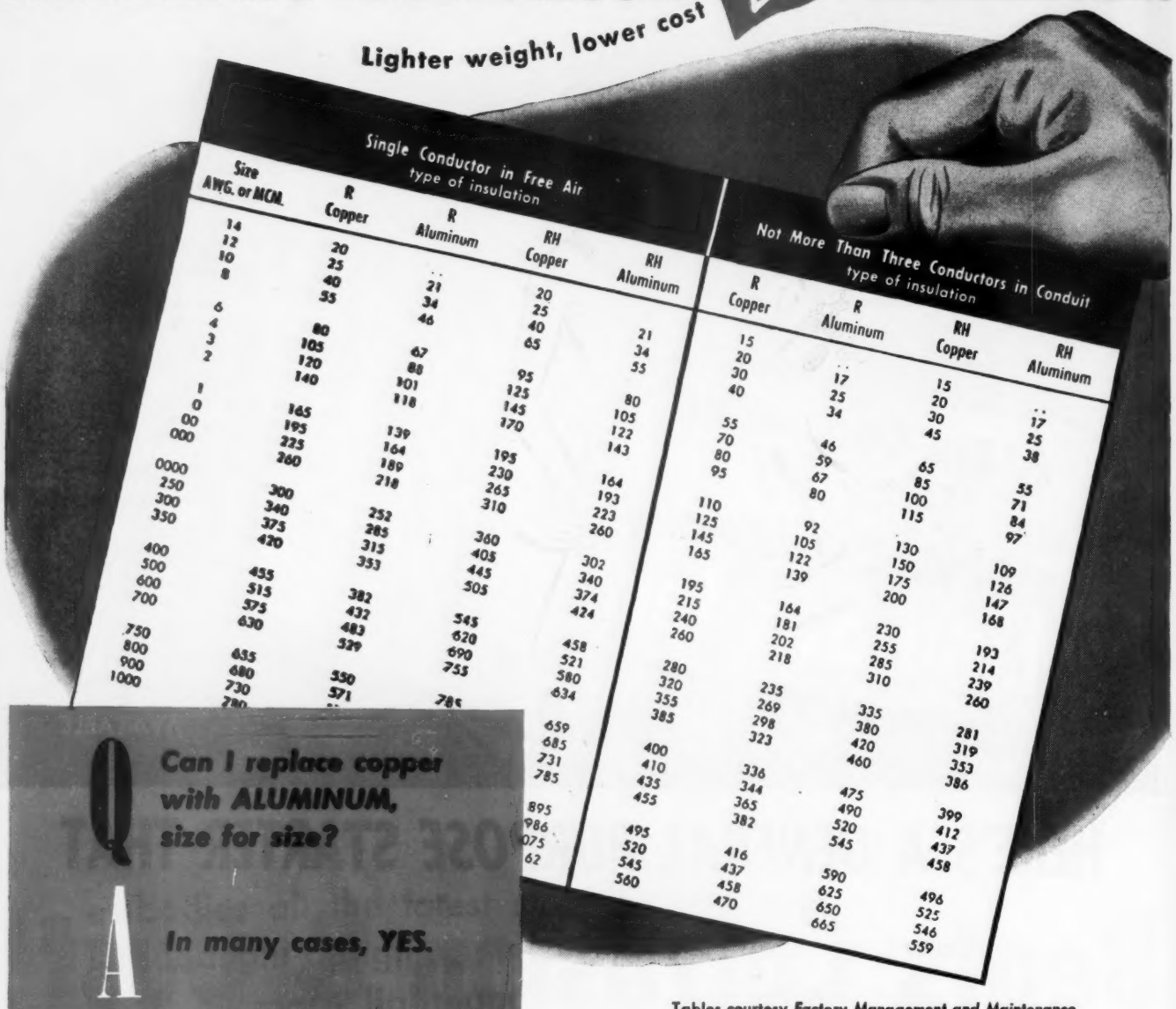
PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

ALLIS-CHALMERS

"You can control any motor with an Allis-Chalmers motor starter."

MORE NEWS ABOUT ALCOA EC ALUMINUM on the job Today

Lighter weight, lower cost



Q Can I replace copper with ALUMINUM, size for size?

A In many cases, YES.

Tables courtesy *Factory Management and Maintenance*, based on tables 1 and 2, National Electrical Code.

Check the current ratings! You'll see that wire and cable with Alcoa E.C.* Aluminum conductor with type RH Insulation can replace copper with type R Insulation. This gives you superior insulation plus aluminum's lighter weight and low cost.

Mechanical, soldered or welded joints are used. Fittings are supplied by reliable manufacturers.

Alcoa makes light, strong, conductive E.C. Aluminum; leading wire manufacturers draw, strand and insulate it, and sell it under their own trademarks. Investigate the savings it can yield on a single job!

Ask your wire supplier, or write ALUMINUM COMPANY OF AMERICA, 2197G Gulf Building, Pittsburgh 19, Penna.

*E.C.: *Electrical Conductor* Aluminum

ALCOA EC ALUMINUM

FOR ELECTRIC WIRE AND CABLE

You can do a *lot*

with a little GOLD SEAL TAPE

Here's a tape you can count on in emergencies. But what makes Gold Seal the lasting favorite of linemen and electricians is that it *goes further* . . . on *any* job.

Gold Seal Tape does not dry out, peel or ravel. It tears evenly, quickly. Production is laboratory controlled to assure plenty of "tack" in the friction compound, a base cloth of high dielectric strength.

There's more tape value in every roll of Gold Seal because there's no waste. It grips tight, forms a firmer, longer-lasting bond, winter or summer. Try it on your next job. See if you don't agree that it's the best buy in tape. In single rolls and handy ten-roll cartons. Each roll is cellophane-wrapped — *factory-fresh.* Jenkins Bros. (Rubber Division), 80 White St., New York 13, N. Y.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet both ASTM and Federal Specifications.

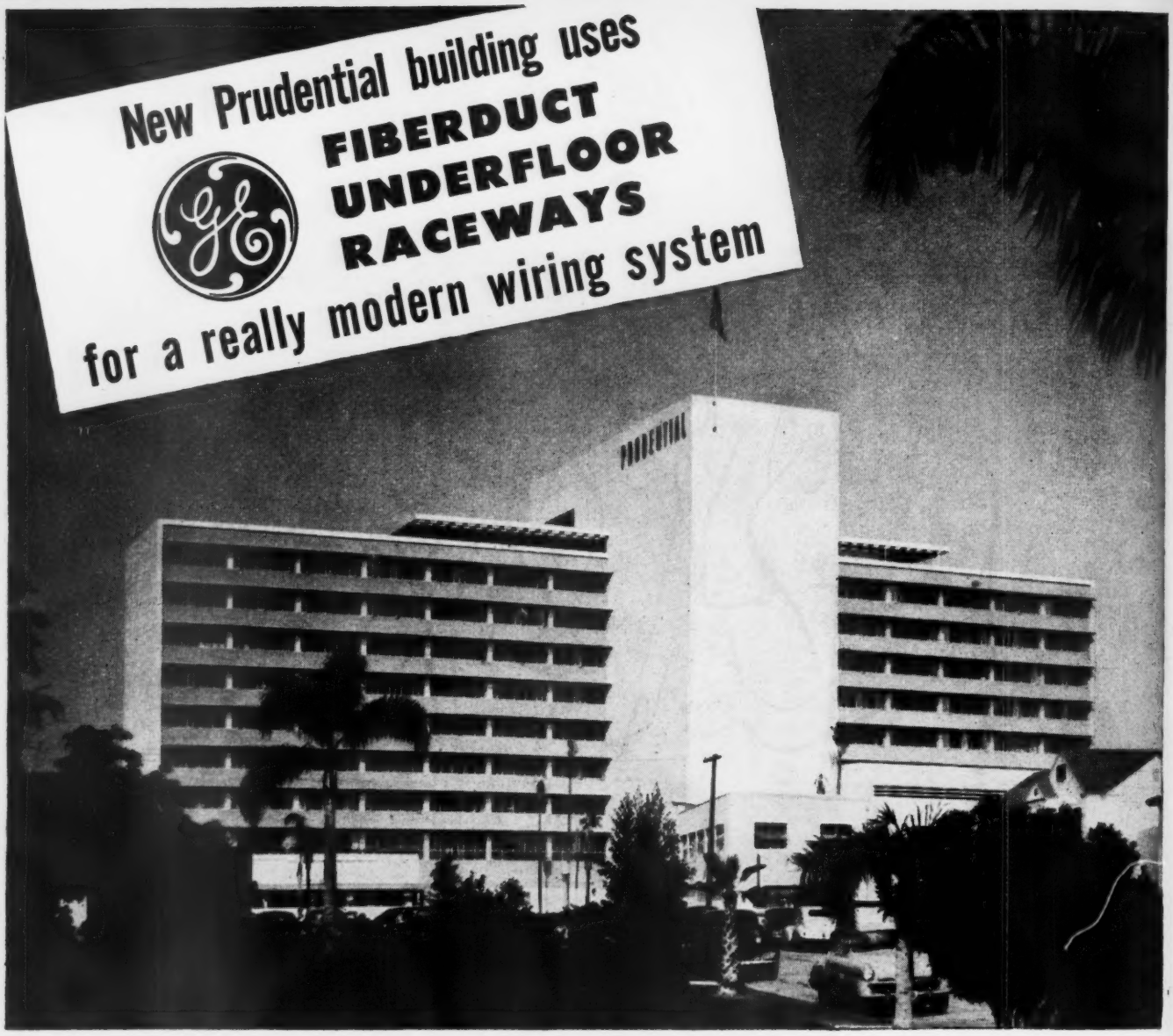
JENKINS *Gold Seal* *Tapes*

TRADE JENKINS MARK Jenkins Bros.

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

New Prudential building uses FIBERDUCT UNDERFLOOR RACEWAYS for a really modern wiring system



Highly dramatic, carefully planned, the Prudential Insurance Company's new Western home office now brings another example of modern workability to the Southern California scene. Realizing the need for a modern, flexible wiring system that matched the workability of the building itself—Wurdeman & Becket, architects, specified a G-E Fiberduct raceway system. This triple-duct system utilizes approximately 80,000 feet of G-E Fiberduct raceways, and supplies three completely separate channels for telephone, signal, and electrical distribution. It provides for immediate wiring changes as personnel are moved, partitions shifted, and business machines and phones are added.

Tomorrow's electrical demands won't find the new Prudential building wanting. Its system of General Electric Fiberduct underfloor raceways will provide complete electrical flexibility in the years to come. When new outlets are needed, when distribution changes are necessary, this underfloor system can provide these facilities at any time.

General Electric Fiberduct raceways give building management complete freedom of floor arrangement, because they permit the installations of outlets at any point along the duct line—at any time during the life of the building. These nonmetallic raceways provide ample capacity for future electrical requirements. In monolithic or slab and fill type of construction they provide an over-all raceway pattern that makes circuits available throughout the floor area.

To provide a new outlet it is only necessary to make a small opening in the floor over the raceway, pull the wires through, and install the outlet. New distribution can be added simply by pulling wires through the ducts. It's as quick and easy as that—the job is done at low cost with no interruption of the building's facilities.

Get complete details on G-E Fiberduct

We've prepared a new 80-page book that gives the complete G-E Fiberduct story. It's packed with the facts you'll want to know—wiring diagrams, installation details, descriptions, and other valuable information. To get your free copy fill in and mail the coupon below.

Section C24-918
Construction Materials Department
General Electric Company
Bridgeport 2, Connecticut

Please send me a free copy of the 80-page book "Fiberduct Data Manual."

Name ..... Title .....

Company .....

Street .....

City ..... Zone .... State .....

GENERAL ELECTRIC

Easy to Install, too..

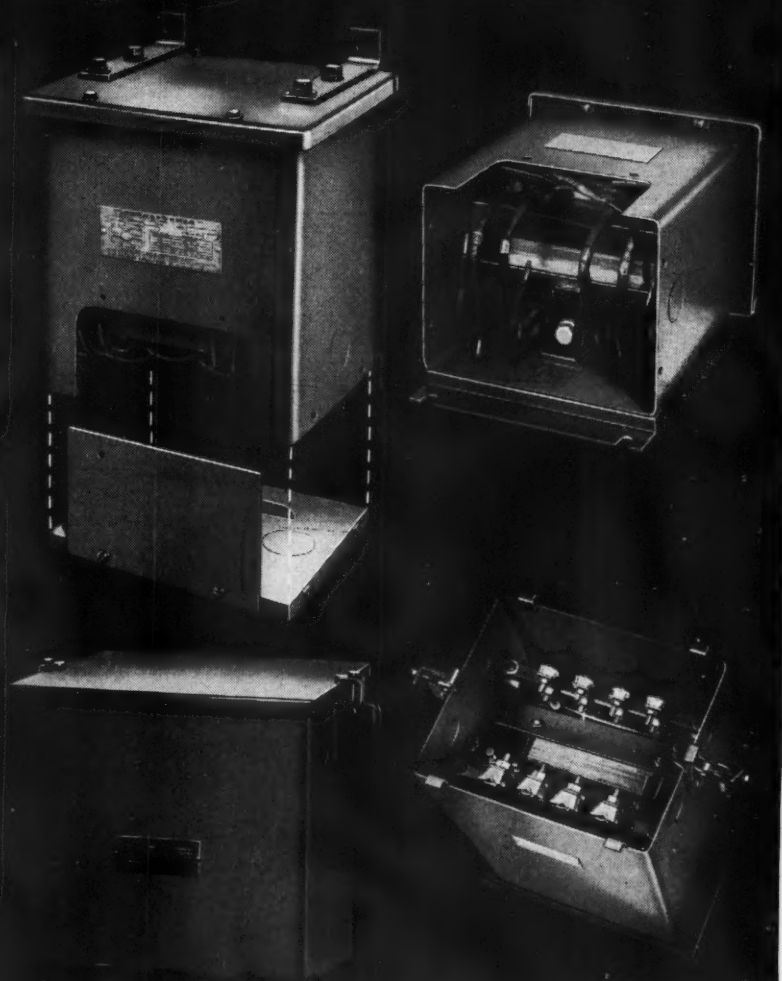
Easy-to-Make Connections Speed Hookup of Allis-Chalmers Dry Type Transformers

HOW IT'S DONE ON RATINGS
10 KVA AND SMALLER — SINGLE PHASE;
25 KVA and SMALLER — THREE PHASE

FRONT AND BOTTOM PLATES drop out to give plenty of working space. Removable front plate permits you to work from the side instead of directly under unit... means safer, faster, easier installation.

HOW IT'S DONE ON RATINGS
15 KVA AND LARGER — SINGLE PHASE;
37½ KVA AND LARGER — THREE PHASE

SOLDERLESS CLAMP CONNECTORS reduce hookup time to a matter of minutes. Just remove top cover and then clamp leads to easily accessible solderless connectors. On sizes above 50 kva, single phase, and 100 kva, 3 phase, flat drilled bars are arranged vertically for any style of connector.



EASIER INSTALLATION is just one of the reasons you'll like Allis-Chalmers Dry Type Transformers. In addition . . .

They're lighter and more compact because they're *Fiberglas* insulated. They're *Spra-Bonderized* for added protection against rust. And coils are impregnated to protect windings from moisture and dirt.

Get more information about these Allis-Chalmers Class B insulated Dry Type Transformers . . . available in 18 sizes up to 300 kva, single and three phase. Contact your nearby Allis-Chalmers dealer or sales office, or write direct for bulletin B6382.

A-2744

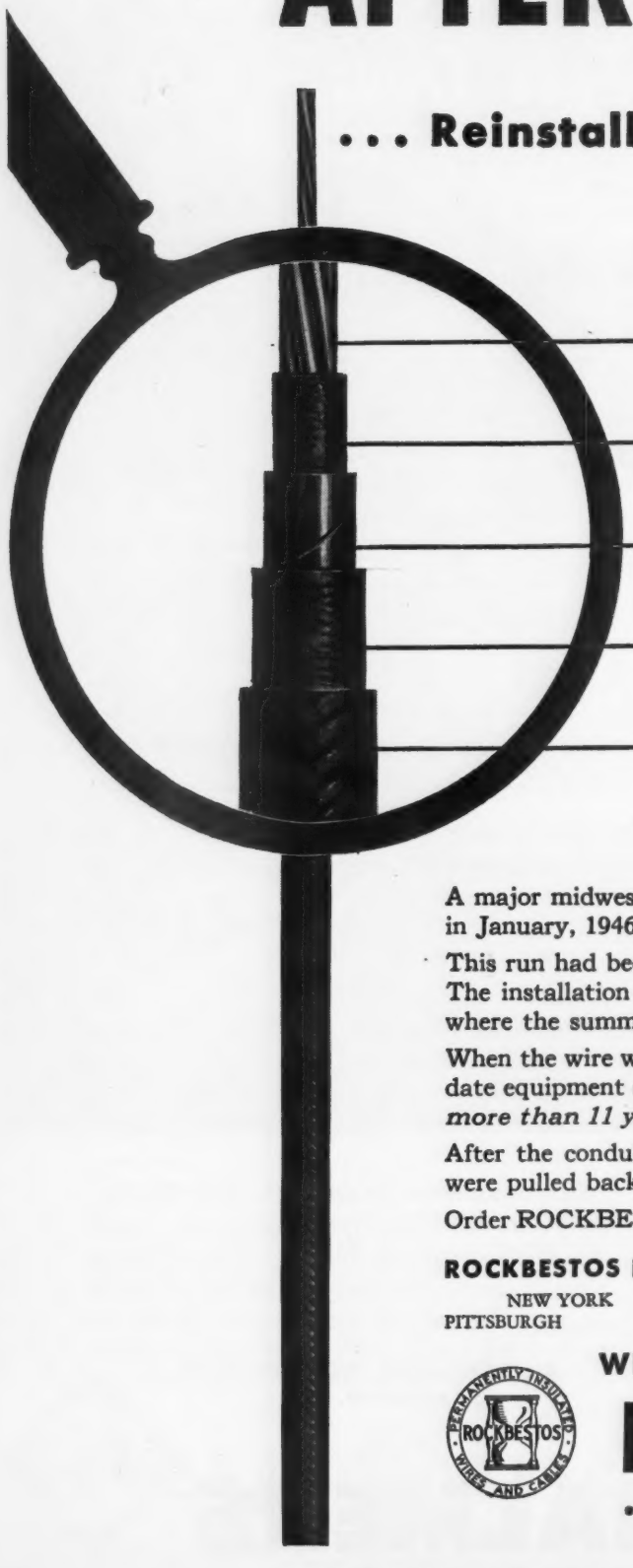
ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Cable pulled from conduit

AFTER 11 YEARS

. . . Reinstalled and back in use!



A major midwestern electric utility had occasion to relocate a conduit run in January, 1946.

This run had been wired with ROCKBESTOS A.V.C. cable in June, 1934. The installation was located in damper control circuits around the boiler, where the summer ambient is around 135°F.

When the wire was pulled out in order to relocate the conduit to accommodate equipment changes, the insulation was in excellent condition . . . *after more than 11 years of dependable service under severe conditions.*

After the conduit was relocated, the same ROCKBESTOS A.V.C. cables were pulled back in.

Order ROCKBESTOS A.V.C. by name. Install it. Then confidently forget it!

ROCKBESTOS PRODUCTS CORPORATION, NEW HAVEN 4, CONN.

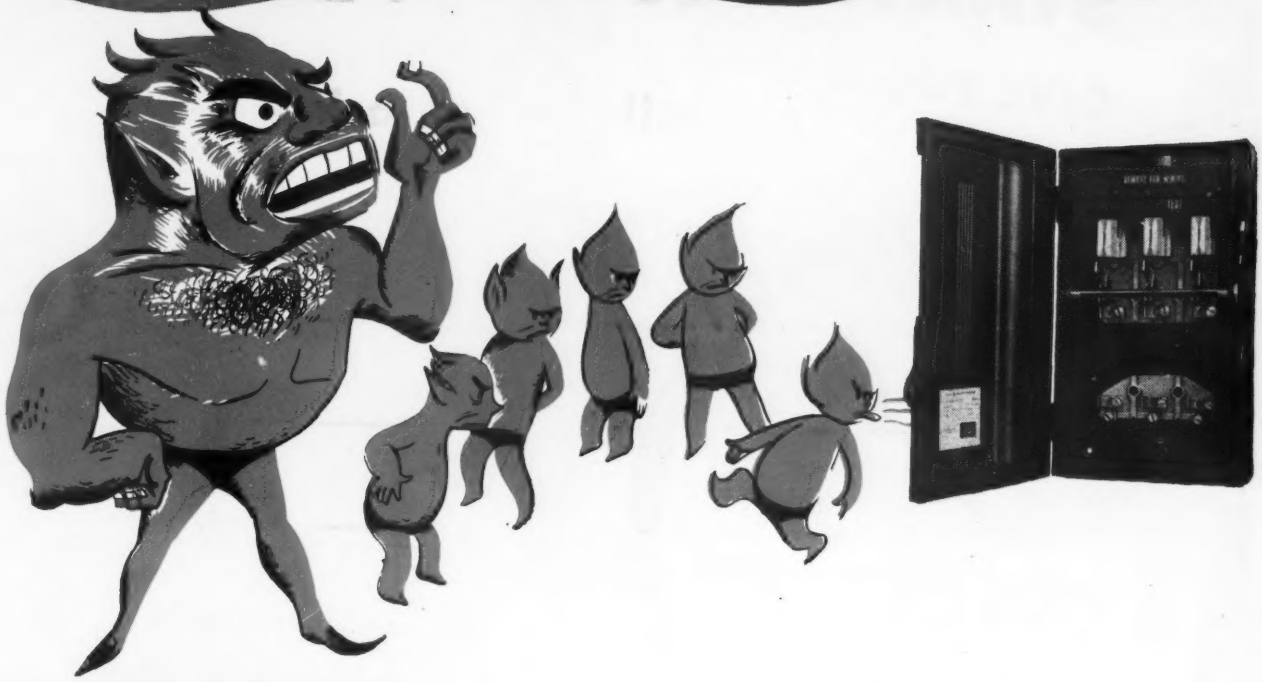
NEW YORK CLEVELAND DETROIT CHICAGO
PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CAL.

WIRES and CABLES by

ROCKBESTOS

. . . . dare to be better

HEAT is foiled here!



• Troublesome "heat" is foiled in the new C-H line of safety switches. They are designed to withstand *safely* any degree of heat that can be expected from correctly selected fuses.

Moreover, these same safety switches are engineered to provide easier installation, greater convenience, better appearance. Users everywhere are insisting on Cutler-Hammer "Beat-the-Heat" Safety Switches, carried by Cutler-Hammer wholesalers and featured by electrical contractors from coast to coast. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin.

CUTLER-HAMMER
SAFETY SWITCHES
C-H

CERTIFIED STARTERS

GIVE YOU A

"Good Break!"

You get a "Good Break" two ways when you insist on Certified Starters for your fluorescent fixtures

1 You get a positive "break" when the tiny bimetal contacts within a Certified Starter break open to provide the needed voltage to start a fluorescent tube.

2 Certified Starters assure good lighting performance—full starter life—long lamp life—and lower maintenance costs.

"Certified" on a starter means it was made to precise specifications, then tested and checked by impartial Electrical Testing Laboratories, Inc.

CERTIFIED ETL

Say "Certified Starters" and get a Good Break

Certified Fluorescent Starter Manufacturers

2116 KEITH BUILDING • CLEVELAND 15, OHIO

Corrugated white translucent PLEXIGLAS *covers the entire ceiling of the main lobby and elevator foyer in the Central National Bank, Cleveland, Ohio. Specifications, developed by the Buckeye Lighting Division of General Electric, called for 1100 sq. ft. of* PLEXIGLAS *#122-125, .125" thick.*

Man Without a Shadow

A man *can* lose his shadow—under a PLEXIGLAS luminous ceiling. Translucent sheets of this acrylic plastic, installed from wall to wall under fluorescent lights, diffuse illumination so completely that shadows are eliminated.

PLEXIGLAS luminous ceilings do more than eliminate shadows. They eliminate glare—both direct and *reflected*. They provide even illumination throughout a room, and insure a low brightness factor. In both performance and appearance, they are pleasing to the eye.

The economy of PLEXIGLAS luminous ceilings matches their efficiency. Better lighting with lower electrical input results from the maximum transmission and minimum absorption of light by white translucent PLEXIGLAS. Installation of the thin, light-weight, remarkably strong sheets is easy and inexpensive. Maintenance costs are negligible, and replacement of the non-discoloring material is unnecessary.

In banks, drafting rooms, stores, classrooms and control rooms, PLEXIGLAS luminous ceilings have already been installed and are meeting every requirement for truly efficient lighting. Write us about *your* lighting problem. We will be glad to tell you more about this new, highly successful means of large-area illumination.

Canadian Distributor:
Crystal Glass & Plastics, Ltd.
282 St. Helens Ave., Toronto, Ont.

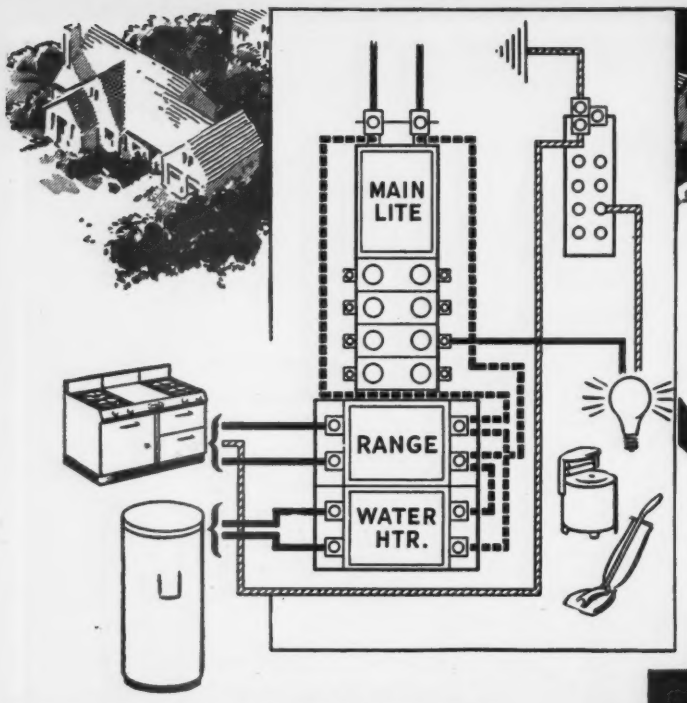
PLEXIGLAS *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

CHEMICALS FOR INDUSTRY

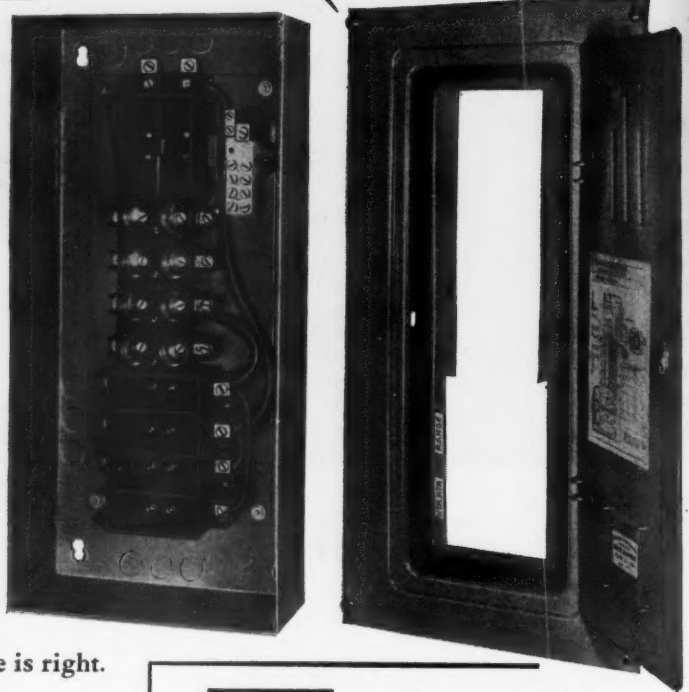
ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries



A NEW Reason why the Switch is to General



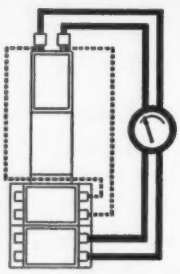
General Switch Cat. No. 663-108, Main-Range-Water Heater Combination Triple Pullout Unit

100 Amp main lugs feed the 60 Amp pull-out switch controlling from 4 to as many as 12 plug fused lighting circuits. The main lugs also feed the Range and Water Heater pullout switches . . . available in 30 or 60 Amp and non-interchangeable to prevent overfusing. Flush or Surface. Underwriter Laboratories approved.

THE new GENERAL Main-Range-Water Heater Combination Triple Pullout Unit, the latest addition to the GENERAL SWITCH extensive line of enclosed switches and panels, means a real saving in time and materials, is a neat, compact unit, is thoroughly dependable and . . . the price is right.

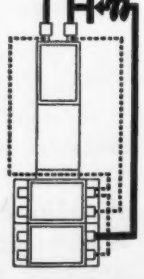
The development of this all-in-one unit is another step forward in the GENERAL SWITCH planned program of product development of "unitized" equipment for simplified electrical systems at lower cost.

Save time and save money . . . investigate this new unit and *Switch to* GENERAL *today*! Available everywhere exclusively through wholesalers.



Separate Meter for Water Heater

Simply remove jumpers and feed the water heater pullout switch through separate meter.



Carrier Relay or Time Clock Water Heater Disconnect

Remove one jumper and connect water heater switch through disconnect element of meter.

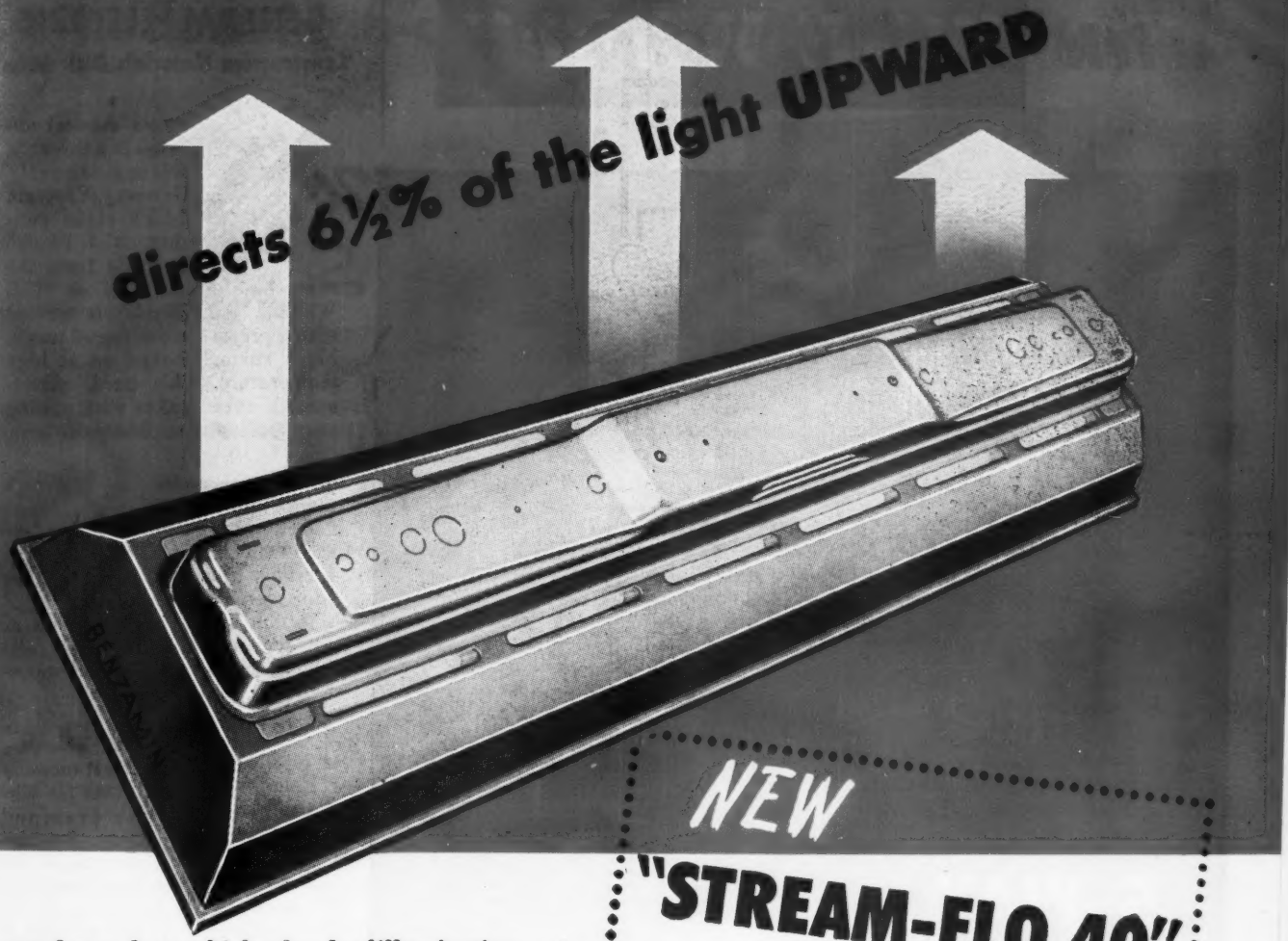
Ask your wholesaler or write today for the GENERAL SWITCH 68-page catalog.

General Switch Corp.

49 Roebling Street Brooklyn 11, N. Y.

SALES OFFICES IN EVERY MAJOR CITY

FOR GREATER BRIGHTNESS CONTROL



NEW "STREAM-FLO 40" DIFFUSER

As industry demands ever-higher levels of illumination, more and more efficient brightness control is necessary to help maintain comfortable seeing conditions without materially reducing lighting efficiency.

Latest and most advanced lighting equipment to be introduced in answer to this problem, is the new Benjamin "Stream-Flo 40" Diffuser... expressly designed for locations where it is desirable to reduce contrasts between the unit and its surround.

This new fluorescent lighting unit incorporates a series of 12 apertures, located on top of the reflector. There are 6 of these elongated openings above each of the two lamps. Together, they direct approximately 6½% of the light upward, to help relieve annoying contrasts between the unit as a light source and its background.

without materially reducing light output, the **"STREAM-FLO 40"** *DIFFUSER*

... helps relieve contrast between upper and lower room areas!

... helps reduce contrast between light source and ceiling!

R-3250

The new "Stream-Flo 40" Diffuser also embodies other refinements which aid in brightness control. Among them are the light diffusing "Life-Time" Porcelain Enamel reflecting surface; the reflector contour which assures correct shielding and efficient light distribution; and the new longitudinal shield* which provides an additional 14° zone of shielding at eye level. These help make possible the attainment and maintenance of higher light levels with greater seeing comfort.

†3-lamp "Stream-Flo 40" Diffuser units are also available.

*Available as optional equipment.

For advance information on 6 important Benjamin developments including the "Stream-Flo 40" Diffuser, write for Pre-View Bulletin AD. 5581, available without cost or obligation.

BENJAMIN ELECTRIC MFG. CO., Dept. H, Des Plaines, Illinois

BENJAMIN

"Stream-Flo 40" Diffuser

FLUORESCENT LIGHTING UNITS

Distributed Exclusively Through Electrical Wholesalers

You know you're right with "G-E White"

1. Tough, baked-on Glyptal* lacquer finish outside
2. Hot-dipped zinc outside
3. High-grade steel
4. Hot-dipped zinc inside
5. Tough, baked-on Glyptal lacquer finish inside

5 WAY WIRING PROTECTION

These are five of the reasons why General Electric white rigid conduit is such a general favorite with electrical contractors and maintenance men everywhere.

Always, when you think of conduit for protection from atmospheric corrosion, think of "G-E White." For further information, see your nearest General Electric Construction Materials distributor, or write to Section C21-918, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

*Trade-mark Reg. U. S. Pat. Off.

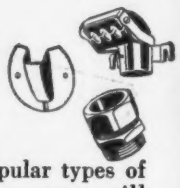
RACEWAYS ROUNDUP

with your

GENERAL ELECTRIC

Construction Materials Distributor

Where chemical corrosion is a threat to wiring, specify General Electric black rigid conduit. "G-E Black" is made from the same high grade steel as "G-E White." "G-E Black" is treated with a protective coating of tough, black enamel, baked on at high temperature. This hard, glassy-smooth finish makes wire pulling easy, and is an excellent paint base.



Service entrance cable fittings in a wide variety are available from General Electric. This line includes a large selection of the popular types of waterproof entrance caps, sill plates, cable straps and watertight connectors.

If you're wondering how to get raceway protection for wiring in cramped quarters, for machine tool or temporary wiring, General Electric flexible steel conduit is the answer. This conduit is strong, yet very flexible. It's quickly installed, and the zinc-coated strip steel is wound in a way that makes wire pulling easy.

Your General Electric distributor can save you lots of time and trouble when you order wiring materials. Because he carries the complete General Electric line, you can order every item you need from him. One order does it — no running around getting part of your order in one place and part in another. It's the kind of "one-stop, one-package" service busy contractors need to help stretch scarce working hours.

GENERAL ELECTRIC

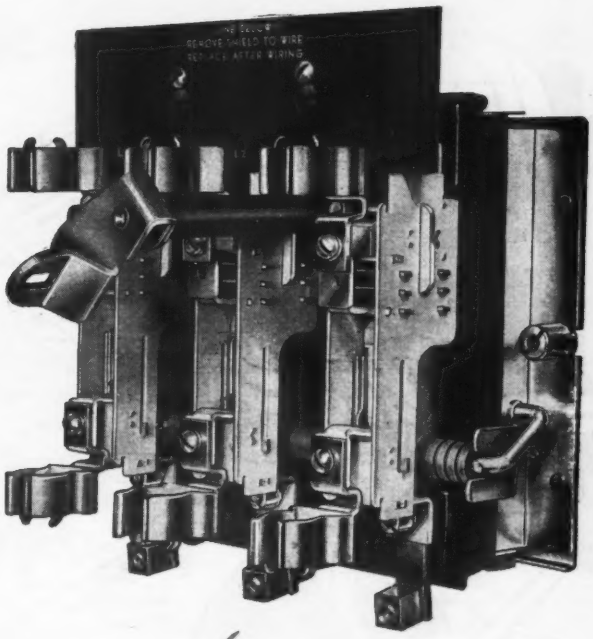
Conduit Products

NOW... an ALL-NEW Type A Safety Switch for modern high-capacity distribution systems...

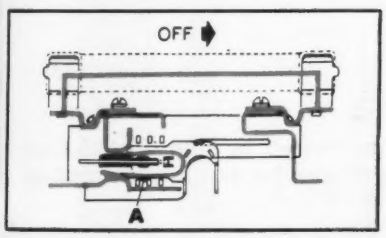
TRUMBULL'S HCI

HIGH CAPACITY INTERRUPTER

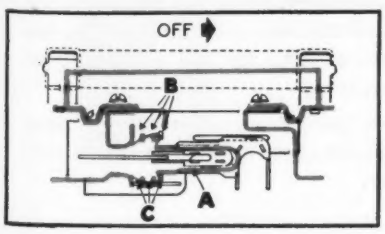
Unusually high interrupting capacity... "circuit-breaker" action breaks heavy loads quickly, safely. Extremely high momentary current capacity . . . withstands heavy short circuits without damage. 30-, 60-, 100-ampere sizes.



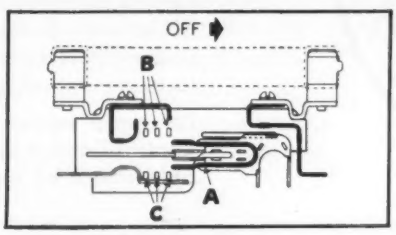
Here's How...
HCI's "Circuit-Breaker" Action Works



1. Switch closed. Spring-loaded sliding contact (A) fully inserted between stationary contacts. Red indicates current.



2. Sliding contact being withdrawn. The two arcs repel each other, are drawn against grid pins (B) and (C), which break and cool them.



3. Contact fully withdrawn. Trumbull's unique "Circuit-Breaker" action has effectively extinguished the arcs.

CHECK THESE ADDITIONAL SPACE-SAVING, TROUBLE-PREVENTING, LIFE-LENGTHENING FEATURES

Center-front operation permits close ganging.

Front fusing allows compact box, yet gives ample wiring space.

No exposed live parts when switch is OFF and door is open.

Handle interlock.

Clear ON and OFF markings both inside and outside.

No dead center—roller-cam action (multiplying linkage design with powerful spring) throws switch to full OFF and ON.

Poles are self-contained switching units for easy replacement.

Silver-plated current-carrying parts prevent oxidation . . . give low-resistance contact.

Insulating parts made of linen melamene, light, strong, arc-resisting.

Enclosed operating mechanism (on 60- and 100-amp. sizes) prevents wire chafing.

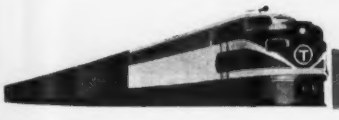
Interior removable for wiring ease.

Underwriters' approval throughout.

For more information about Trumbull's all-new HCI Safety Switch, write for your free copy of Bulletin TEC-10 today. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Connecticut.

Men Who Observe the Best Electrical Practice Make It a Practice to Use

TRUMBULL (T) ELECTRIC



TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

Your Central Conduit Distributor is a dependable source of supply

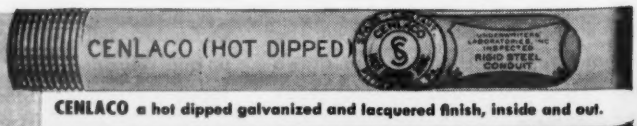
CENTRAL
SPANG
CONDUIT

The complete stocks maintained by your Central Conduit Distributor make it easy for you to get electrical supplies quickly.

Electrical Raceways are a good example of his fine selection of material. Spang's rigid steel conduit comes in three finishes: *Cenlaco* has a hot dipped galvanized and lacquered finish inside and out; *Central White* is electro galvanized outside and black enameled inside; *Central Black* has a permanent, baked on black enamel finish, inside and out. All of these are approved by the Underwriters Laboratories Inc., for use in hazardous locations and occupancies.

For good service and quality materials contact your Central Conduit Distributor—you'll find he's a dependable source of supply.

SPANG-CHALFANT
Division of The National Supply Company
General Sales Office: Grant Building, Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

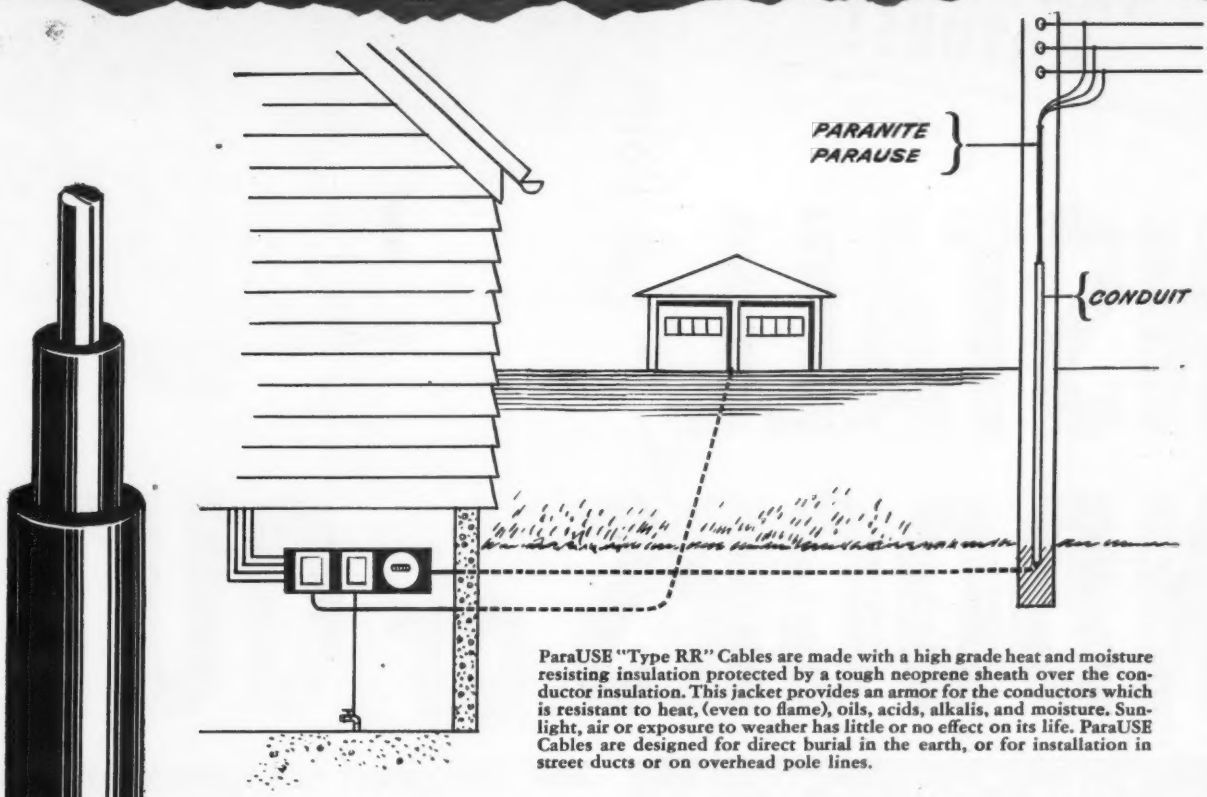


CENLACO a hot dipped galvanized and lacquered finish, inside and out.

CENTRAL WHITE electro-galvanized outside and black enameled inside.

CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

THERE'S LESS OVERHEAD WHEN YOU USE THIS *UNDERGROUND*



ParaUSE "Type RR" Cables are made with a high grade heat and moisture resisting insulation protected by a tough neoprene sheath over the conductor insulation. This jacket provides an armor for the conductors which is resistant to heat, (even to flame), oils, acids, alkalis, and moisture. Sunlight, air or exposure to weather has little or no effect on its life. ParaUSE Cables are designed for direct burial in the earth, or for installation in street ducts or on overhead pole lines.

PARANITE "ParaUSE" CABLE "TYPE RR"

NON-METALLIC — NEOPRENE SHEATH

ParaUSE "Type RR" Parkway Wire and Cable provides economical permanent underground installation from power line to meter and for connecting several buildings from the same service. Examples of its application are on farms, estates and institutions, and for lighting streets, airports, ball parks, drive-in-theatres and many other outdoor lighting and power circuits.

It eliminates the trouble from sleet, windstorms and weathering. Unsightly outside wire is also done away with. You save labor. You save time. Simply dig a trench and cover; no other protection necessary.

IF IT'S **PARANITE** IT'S RIGHT!

DISTRIBUTED THROUGH WHOLESALERS

PARANITE WIRE AND CABLE

Division of ESSEX WIRE CORPORATION

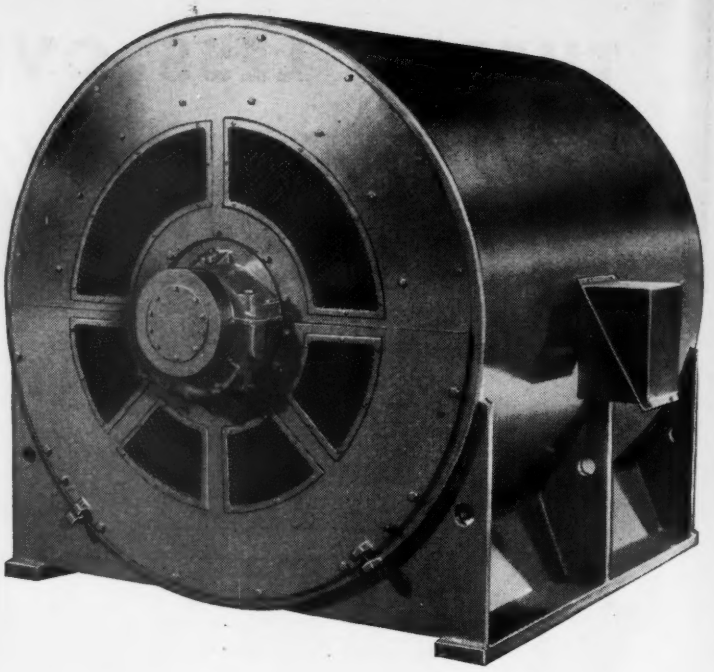
FORT WAYNE 6, INDIANA

PARANITE

WAREHOUSES* AND SALES OFFICES: *Atlanta, Ga.; Boston, Mass.; *Chicago, Ill.; Cleveland, Ohio; Dallas, Texas; *Detroit, Mich.; *Kansas City, Mo.; *Los Angeles, Calif.; *Newark, N. J.; Philadelphia, Pa.; *Portland, Oreg.; *St. Louis, Mo.; *San Diego, Calif.; *San Francisco, Calif.

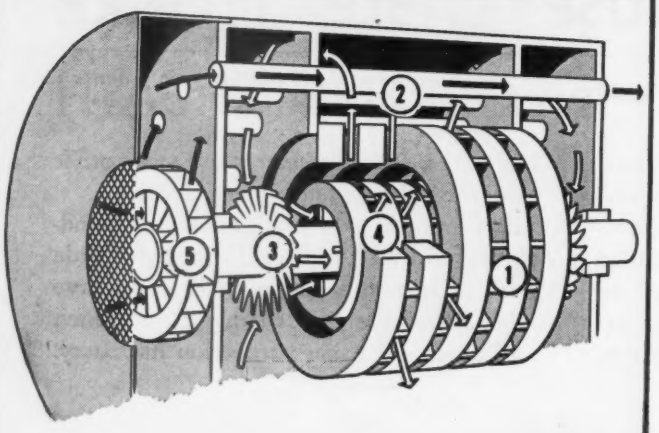
ELECTRICAL WIRES AND CABLES *"BETTER THAN CODE REQUIRES"*

TUBE-TYPE
TOTALLY-ENCLOSED FAN-COOLED MOTORS!



INSTALL INDOORS or OUT!

How Tube Cooling Works



Stator core (1) is surrounded by tubes (2). Internal fans (3) circulate air through ducts (4) in rotor and stator and around tubes, transferring heat to tubes. External fan (5) drives outside air through tubes, removing heat and keeping tubes clean. All electrical parts are enclosed. Dirt cannot enter.

- **Dirt-proof and corrosion-resistant**
- **Heat exchanger is practically *self-cleaning***
- **Simple self-contained cooling system—sizes from 75 to several thousand horsepower**

WHEREVER DUST, DIRT, fly ash, rain and snow, smoke, or corroding fumes keep motor maintenance costs high, this Allis-Chalmers tube-type motor will cut maintenance sharply.

All electrical parts—including stator core—are enclosed. Simple heat transfer system keeps temperatures well within rated limits. Cleaning is rarely needed because air passages are unrestricted. Air flow through the straight tubes removes foreign matter.

Important savings have been proved in three years of field operation. Sizes from 75 hp and up. Also explosion-proof designs. For complete information, outline your requirements to your A-C Sales Office, or write for Bulletins 05B7150 and 51R7149. A-2610

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE. WIS.

ALLIS-CHALMERS

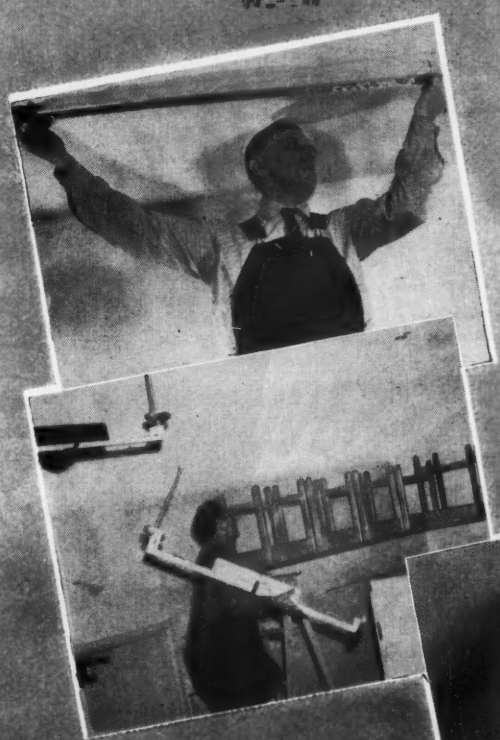
Ease of Installation

IS A FEATURE OF Wakefield LIGHTING EQUIPMENT

Almost like hanging a picture . . .

Everything hooks on to pre-installed straps . . .

A one-man job . . .



The secret is the pre-installed strap. First step is to secure a mounting strap to the outlet box. Next run a chalk line along the ceiling, measure off the required intervals and then attach the other mounting straps in the line. The easily assembled units are then hung on the mounting straps, unit by unit, the supporting band on the previously mounted unit providing the reflector support for the end of the next unit. A steel channel insures rigidity for the wireway, and snap-on wireway covers give accessibility for wiring. Writes one power company engineer: "Contractors have been vociferous in their praise of the ease with which they were able to install your fixtures."

1. Fully Guaranteed
2. A.F. of L. Labels
3. Underwriters Approved
4. Certified Ballasts

Catalog No. 50 just off the press—write for your copy!

THE F. W. WAKEFIELD BRASS COMPANY, VERMILION, OHIO

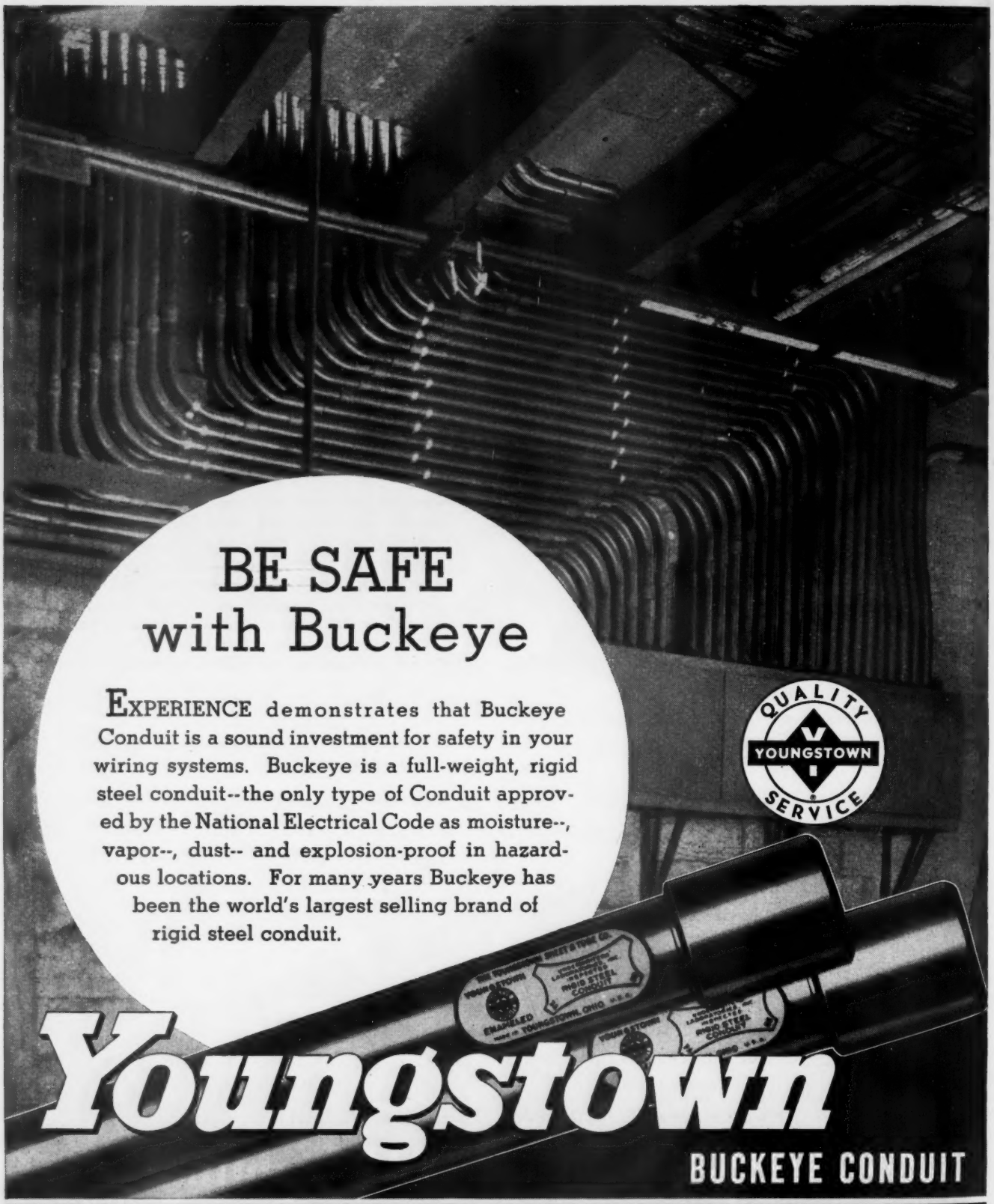
Wakefield Over-ALL Lighting

THE GRENADIER II

THE COMMODORE

THE STAR

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*


BE SAFE
with Buckeye
EXPERIENCE demonstrates that Buckeye Conduit is a sound investment for safety in your wiring systems. Buckeye is a full-weight, rigid steel conduit--the only type of Conduit approved by the National Electrical Code as moisture--, vapor--, dust-- and explosion-proof in hazardous locations. For many years Buckeye has been the world's largest selling brand of rigid steel conduit.
QUALITY
YOUNGSTOWN
SERVICE
Youngstown
BUCKEYE CONDUIT

THE YOUNGSTOWN SHEET AND TUBE COMPANY — General Offices — Youngstown 1, Ohio

Manufacturers of Carbon, Alloy and Yoloy Steel — Export Office - 500 Fifth Avenue, New York

CONDUIT · PIPE AND TUBULAR PRODUCTS · BARS · RODS · COLD FINISHED CARBON AND ALLOY BARS · SHEETS · PLATES · WIRE · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · RAILROAD TRACK SPIKES.

BLACKBURN *Hi-Strength* TWO-BOLT CLAMP

ECONOMICAL! EFFICIENT! COMPACT!

LISTED UNDER REEXAMINATION SERVICE UL UNDERWRITERS' LABORATORIES, INC. OF

HERE'S A *UNIVERSAL* CABLE CONNECTOR FOR INSIDE AND OUTDOOR USE

- It costs much less than other types of connectors.
- It's an ideal connector for splices and taps. It's easy to install and is fully approved by Underwriters.
- It's compact and easy to tape.
- It makes a very high pressure joint which results in a tight, low-resistance, *trouble-free* connection.
- It is made of high strength materials throughout — it's truly a quality connector.

Cat. No.	Main	Tap
2B—1/0	1—1/0	6—1/0
2B—2/0	1/0—2/0	6—2/0
2B—4/0	2/0—4/0	6—4/0
2B—350	250—350 MCM	1/0—350 MCM
2B—500	400—500 MCM	2/0—500 MCM
2B—750	600—750 MCM	4/0—750 MCM
2B—1000	800—1000 MCM	4/0—1000 MCM

Jasper Blackburn Products Corp.

Builders of Quality Connectors for 15 Years

FIRST, MADISON AND CLINTON STS. • ST. LOUIS 6, MO.

Phone CEntral 3007

Mail Coupon for Sample and Full Details

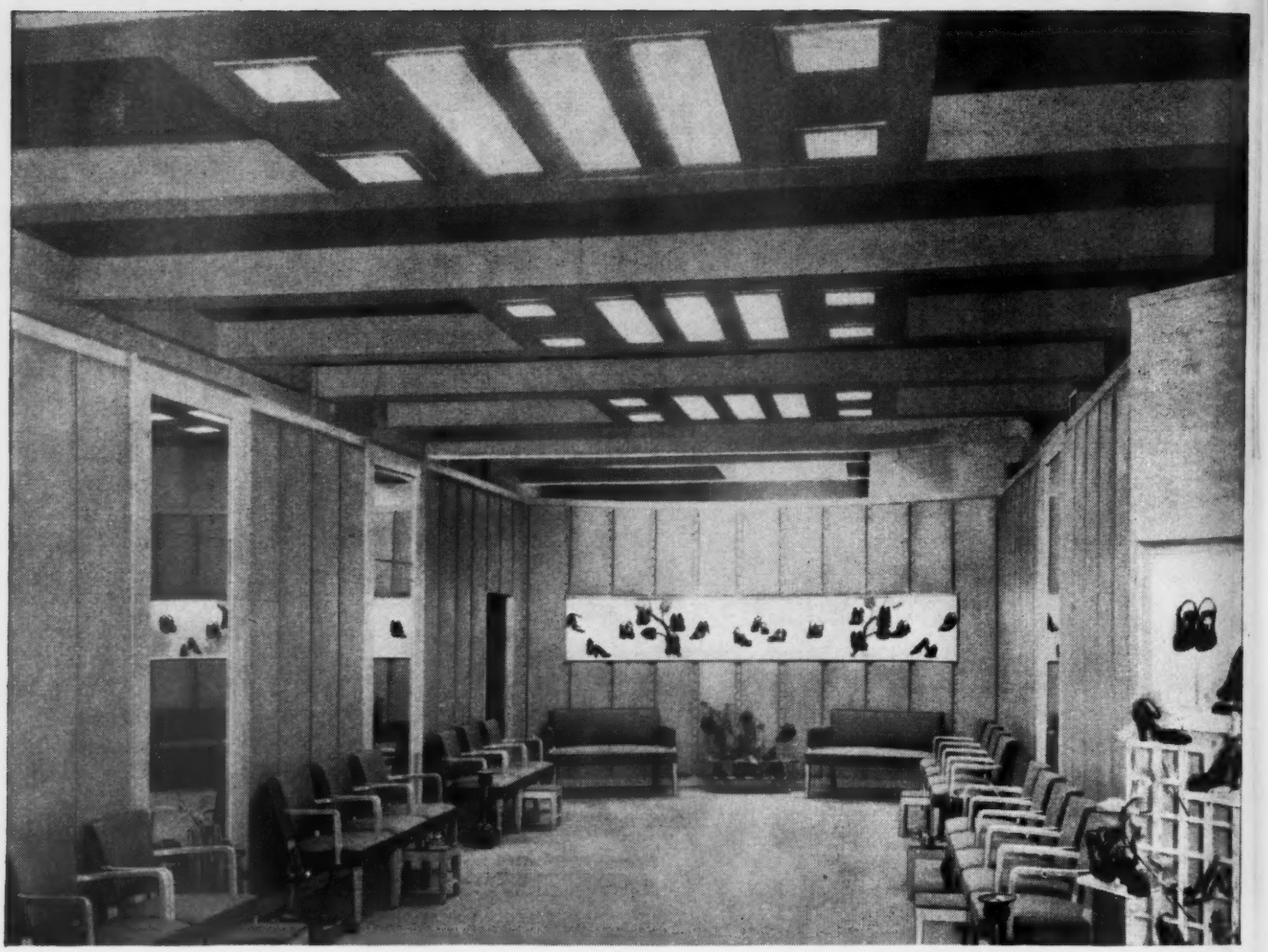
Send me sample and further information on the BLACKBURN TWO-BOLT CLAMP.

*Wire Size Used*_____

*Your Name*_____

*Company*_____

*City & State*_____ EC



. . . at BERRY-BURK & CO.
Richmond, Virginia

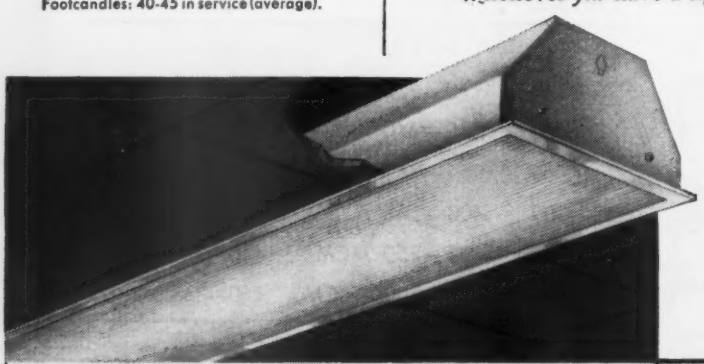
Architects: Marcellus Wright and Son
Consulting Engineer: Mr. George Wagner, V.P. of Morris Hunter Inc.
Electrical Contractor: Morris Hunter Inc
Lighting Equipment: Litecontrol No. 3234 troffer-type lens unit plus recessed lens boxes.
Lamps: 40 watt, white, fluorescent; 200 watt incandescent.
Wattage per fixture: 150 fluorescent; 200 incandescent.
Footcandles: 40-45 in service (average).

Shoe Sales Jumped

When they Relighted this Showroom

Increased shoe sales immediately resulted from this unusual lighting installation using Litecontrol fixtures. And the sales curve kept right on climbing for the ample, glareless light brought out all the sleek beauty of the fine footwear . . . made buying easier, selling easier.

Whenever *you* have a lighting problem come first to Litecontrol. You'll find every good type of fluorescent unit in this wide line of graceful, sturdy fixtures. Furthermore, you'll find our Lighting Engineers a real help in supplying unusual ideas and complete lighting layouts.



. . . with LITECONTROL NO. 3234 FIXTURE

Used so successfully in this installation is a strikingly simple recessed unit that gives efficient utilization of all the available light. Merely pushing up on the Holophane Controlescent® lenses, and sliding them out, gives access to the inside for maintenance.

Cat. No.	Lamps	HOUSING Length	HOUSING Width	HOUSING Height	TRIM Length	TRIM Width	Approx. Weight
3224	2-40W	48"	11¾"	6¾"	50½"	13⅜"	38 lbs.
3234	3-40W	48"	11¾"	6¾"	50½"	13⅜"	43 lbs.

3200-3 End Cap; or 3200-6 Suspension Strap

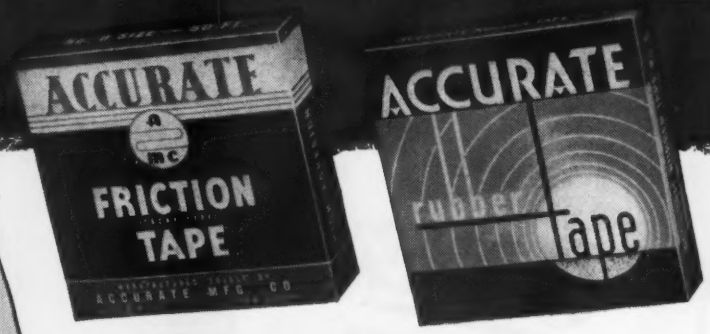
LITECONTROL CORPORATION
36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

LITECONTROL *Fixtures*

KEEP UPKEEP DOWN

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

ACCURATE TAPES



WORK BETTER
—because they're made better!

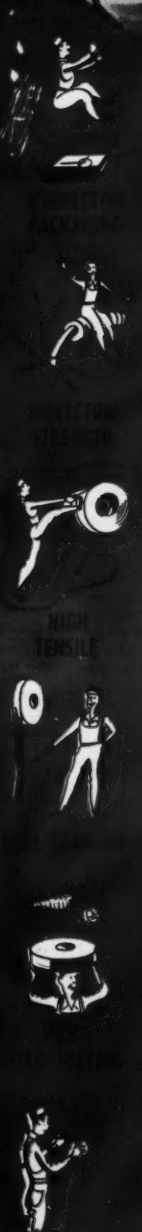
TAKE A GOOD LOOK AT THE TAPE YOU USE—

Every package of ACCURATE tape helps you produce better taped joints in less time. You know this as soon as you've stripped the first length off a new roll. The tape peels off straight and neat without ravelling —tapes up tight and even on the joint —and breaks clean right where you tear it. ACCURATE tapes work better because they're made by men who specialize in tape making.

—if it's

ACCURATE TAPE
here's what you'll find!

First you'll see proper protective packaging. Substantial protective carton; heavy cellophane wrapper inside. Hold a length to a bright light—no pinholes anywhere. Then, when you use it, you'll notice ACCURATE tape never creeps or ravels and breaks off straight and neat. There's more than meets the eye, too. Every foot of ACCURATE tape is made to ASTM Standards and every roll contains guaranteed footage. That's why—when you buy ACCURATE tapes—you get real tape value. Next time you need tape—order ACCURATE. Write for catalog and name of distributor nearest you.



ACCURATE MFG. COMPANY

GARFIELD, NEW JERSEY

Something Better Has Come to Light

PITTSBURGH

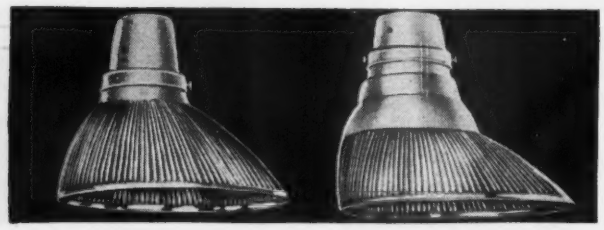
LIGHTING

THE **ONE** UP-TO-DATE COMPLETE LINE

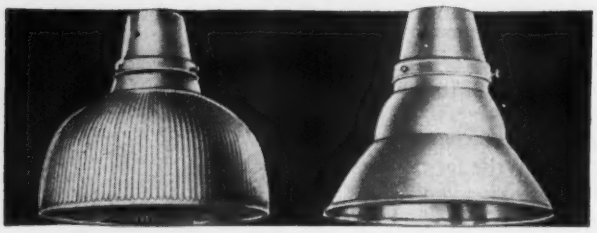
THAT MEANS

All-around application, efficient performance, easy installation and long service life make Pittsburgh Permaflector Lighting Equipment the practical and profitable line to handle for every commercial, industrial and institutional need.

INCANDESCENT LUMINAIRES for direct or indirect lighting with direct component, are in the standard line. Units have spun aluminum housings and silvered-glass Permaflectors.

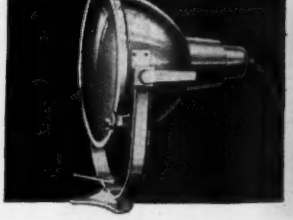


SHOW-WINDOW PERMAFLECTORS, the permanently efficient silvered glass reflectors backed by a ten year guarantee, are available in various combinations for lighting shallow, island, medium and deep windows of low, medium or high ceiling heights. The flexibility of Permaflector Show-Window Equipment permits many varied arrangements . . . all of which can be easily and quickly achieved with the standard units.



CEILING RECESSED PERMAFLECTORS of broad or concentrated distribution for all types of mounting arrangements and for every interior lighting application are part of the standard Pittsburgh Permaflector Incandescent line. Combinations are available for external mounting, as well as recessed ceiling installations. A wide variety of accessories meets the specific illuminating requirements of any and all types of interiors.

HIGH-BAY INDUSTRIAL UNITS, in enclosed or open types utilizing incandescent and/or mercury vapor lamps, are designed especially for high-bay lighting, gyms and similar applications.



WEATHER-PROOF FLOODLIGHTS of rugged aluminum construction are available in 200-W to 1000-W units. Precision engineering assures dependable illuminating results.

PITTSBURGH REFLECTOR COMPANY

404 OLIVER BUILDING • PITTSBURGH 22, PENNSYLVANIA

PITTSBURGH PERMAFLECTOR ENGINEERS IN ALL PRINCIPAL CITIES

PERMAFLECTOR

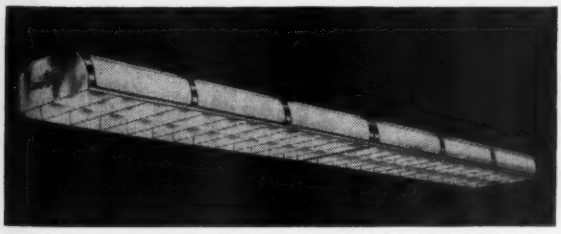
EQUIPMENT

Now Ready!

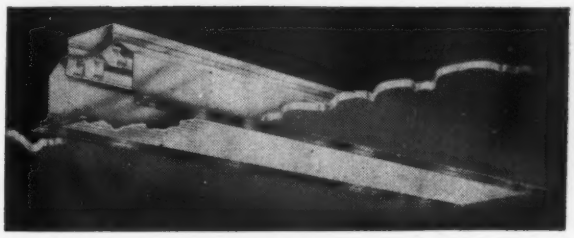
T-12 SLIMLINE TROFFERS and LUMINAIRES

MORE SALES

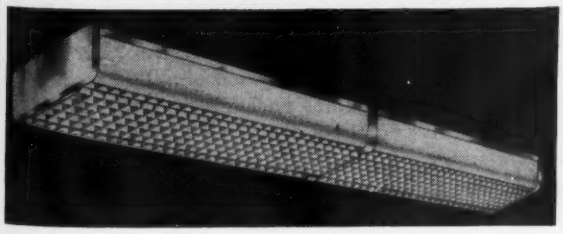
With standard Pittsburgh Permaflector Fluorescent and Incandescent Units, you can offer maximum service with minimum stocks, minimum investment, minimum inventory. And you can furnish *exactly* the units needed for each job.



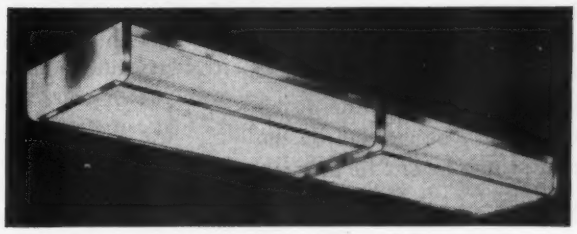
THE "MONROE" SLIMLINE LUMINAIRE is especially designed for low initial and installation cost. The 96" units utilize T-8 slimline or T-12 lamps; the 48" units use T-12 lamps. This series may be had in a choice of framed plastic, aluminum or steel side-panels which snap into position after the chassis is hung. Stock unit gives direct and indirect lighting; reflector-closure attaches to the unit for totally direct lighting.



THE "UNIVERSAL" TROFFER, in T-12 or T-8 slimline 96" and standard 48" lengths, may be installed individually, in continuous rows, patterns, squares, etc. The troffer-chassis can be equipped with egg-crate louver, Alba-Lite glass-panel, baffle-louver or lens-panel shielding accessories. Four different incandescent downlights are available for this series for crossover, Tee, corner and other "pattern" installations.



THE "WASHINGTON" SLIMLINE LUMINAIRE features an egg-crate louver bottom and Skytex satinol glass side-panels. It is made in 2, 3 and 4 lamp models. Like other Presidential slimline luminaires, standard operation is 425-MA with T-12 lamps; but it is also made for 120, 200 or 300-MA with T-8 lamps. Bridge-truss construction assures a unit which "hugs" the ceiling when it is surface mounted individually or in continuous runs.



THE "HARRISON" SLIMLINE LUMINAIRE, in 2, 3 or 4 lamp models, is designed for surface or pendant mounting, individually or in continuous rows . . . as are all luminaires in the Presidential series. Gracefully curved side-panels and Alba-Lite glass bottom-panels distinguish this new 96" slimline luminaire. Companion incandescent units are designed especially for use with the "Harrison" and other Presidential units.

FOR ACCENT LIGHTING AT ITS BEST—SEE THE MANY COMPANION INCANDESCENT UNITS DESIGNED FOR USE WITH PITTSBURGH PERMAFLECTOR FLUORESCENT LUMINAIRES & TROFFERS.

DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

the *Vital* Part of a Unit Substation is the Transformer

• Wagner Unit Substation Transformers can be Throat Connected to any make of Switchgear...The transformer is the vital part—the fuel pump—of a load center distribution system. If the transformer fails, the entire system is dead, whereas only part of the distribution system may be affected by the failure of a switch or circuit breaker.

You can be sure of a dependable continuous flow of power from a Wagner transformer and you can be sure that it has been carefully designed to meet your distribution requirements.

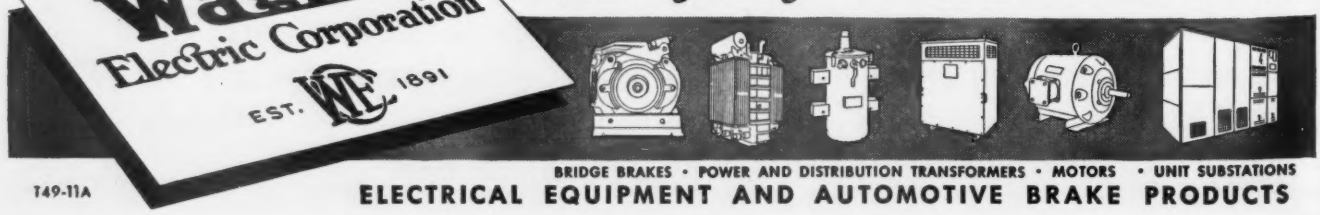
Wagner unit substation transformers with incoming high voltage switch sections to meet your requirements, and with proper throats on the secondary side for connection to any make of switch-gear, are available in the usual range of ratings up to 2000 kva. Our factory-trained sales engineers are well qualified to recommend the various combinations necessary to handle your unit substation requirements and will gladly give you immediate service.

Wagner unit substation transformers are installed in numerous electric generating stations and in all kinds of industrial plants including synthetic rubber, petroleum, steel, chemical, aircraft, automotive, paper, and many others. The importance of the transformer in a unit substation justifies calling in the Wagner sales engineer to help solve all your load center problems.

Our free bulletins TU-13 and TU-56 describe the design and construction features that make Wagner liquid-filled and dry-type unit substation transformers outstanding.

Wagner Electric Corporation
6413 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.

Consult Wagner Engineers on All Transformer Problems



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS
ELECTRICAL EQUIPMENT AND AUTOMOTIVE BRAKE PRODUCTS

T49-11A

On Rough Jobs, Smooth Performance

Mining coal is hard work. It is hard on men, it is hard on equipment. It is especially hard on the portable cables that must keep vital mining machinery supplied with electric power.

Yet, severe as this service is, Simplex-TIREX Cables, during more than a quarter-century in the mines, have gained a reputation for unusually long life and trouble-free performance.

Despite runovers by heavy machines which crush and twist the cables; despite the strain of continual reeling and unreeling as machines travel about the mine; despite being dragged over rough beds of coal, through water, oil and grease, and being pulled around sharp corners, TIREX Portable Cables have consistently come through with the failure-free operation this important service demands.

Is it hard to believe, then, that these same TIREX Cables will increase the efficiency of your work by serving your portable electric equipment longer, more dependably and more economically?

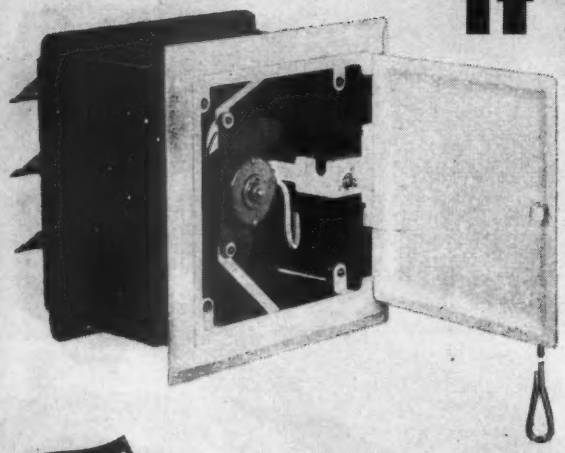
They're available to you in sizes and types that meet the requirements of all portable apparatus from hand tools to motors, lighting units, welding machines, shovels and cranes. Ask our representative in your area for full details, or write us direct for Catalog 994.

Simplex-Tirex

SIMPLEX WIRE AND CABLE COMPANY, 79 SIDNEY ST., CAMBRIDGE 39, MASS.

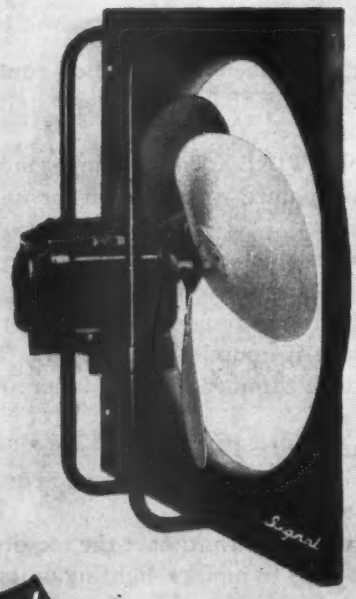
For Healthful...Controlled... LOW-COST Ventilation!

it's *Signal*



Signal KITCHEN VENT FANS

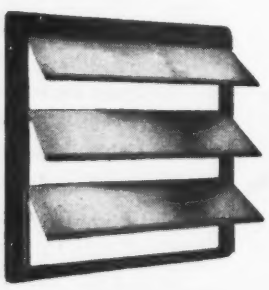
Fit varying wall thicknesses 6" to 24"; automatic operation; 10" blade; rubber mounted, self-lubricating motor is fully enclosed.



Signal CHALLENGER VENT FANS

Five sizes—10", 12", 16", 20", and 24"; continuous duty motor, fully enclosed; porous bronze, self-lubricating bearings.

New construction or remodeling calls for planned ventilation. Yes, hard working breezes are now built-in where you want them— in kitchens, recreation rooms, attics and utility rooms. *Signal* vent fans have a performance-proven reputation for being dependable, quiet, economical and EASY TO INSTALL. Men who *know*, specify *Signal*. Write for free catalog, or get all the details from your *Signal* supplier today!



AUTOMATIC SHUTTERS
Provide outside protection for *Signal* Exhaust and Vent Fans.

TWO-SPEED SWITCH
Available with *Signal's* Challenger Line Vent Fans.

Signal SIGNAL ELECTRIC MFG. CO.
Dept. C-5, Menominee, Michigan

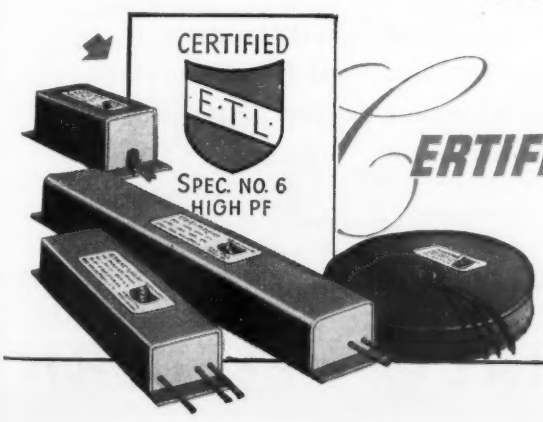
Certified Ballasts = Dependable Lighting Performance

• You can be sure of long, dependable service from fluorescent fixtures by insisting on Certified Ballasts in the equipment.

Certified Ballasts deliver... Full lamp life
Rated light output
Dependable performance

The reason for this is: Certified Ballasts are made to precise specifications ... specifications which conform to the exact requirements of fluorescent lamps ... then tested, checked and certified by impartial Electrical Testing Laboratories, Inc.

All Fleur-O-Lier fixtures use Certified Ballasts.



CERTIFIED BALLAST MANUFACTURERS

Makers of Certified Ballasts for Fluorescent Lighting

2116 KEITH BLDG., CLEVELAND 15, OHIO

To simplify your motor repairs

USE THIS NEW GENERAL-PURPOSE* INSULATING VARNISH...

G.E.'s 9574

Here at last is a top-quality insulating varnish that you can use with real assurance in repairing ALL TYPES OF MOTORS (except extra high-speed armatures). It's General Electric's new 9574, developed after long research and careful testing under all kinds of operating conditions. These are some of the advantages that this material offers you:

OUTSTANDING
BONDING STRENGTH
Combines excellent adhesive properties with flexibility, plus extreme toughness and hardness. High-temperature bonding is excellent.

EXCELLENT
ELECTRICAL PROPERTIES
Dielectric strength (volts/mil) 1800—2000. After 24 hours in water at 25 C (volts/mil) 700.

UNUSUAL
CHEMICAL RESISTANCE
Salt-water resistance—Excellent
Alkali resistance—Excellent
Acid resistance—Excellent
Oil resistance—Excellent

Easier to use. G-E 9574 is a phenolic drying-oil varnish. It's remarkably easy to handle, yet it gives maximum protection as a general-purpose insulation. High flash point (100 F). And its viscosity of 250 C. P. average (at 45 F) makes it usable at barrel gravity. No special thinners required—use petroleum spirits.

Cures at low temperatures. This clear-baking varnish cures at low temperatures. A baking cycle as low as 212 F is satisfactory with conventional equipment. Also cures by infra-red.

Try 9574 on your motors—Simplify your repair work; note the exceptional resistance qualities it offers you to provide LONGER LIFE for the motors you repair. For more details, write for new bulletin to your local G-E Distributor or Section 25-9, Chemical Department, General Electric Company, Pittsfield, Massachusetts.

**G-E 9574 gives excellent results on all types of coils except extra high-speed armatures.*

You Can Put Your Confidence in

GENERAL ELECTRIC

CD49-M3

NOW the beautiful new GIBSON Highlander

Gives you the rare combination of Beauty and Efficiency PLUS LOW UNIT COST

Here it is—the all-purpose lighting fixture you've been wanting! An overall efficiency of nearly 80% . . . and smooth modern lines . . . give the new Highlander the widest possible range of applications—public buildings, stores, schools, offices. And its VERY LOW COST meets nearly any budget requirement.

PRECISION CONSTRUCTED . . . each fixture is wired with E.T.L. approved brick type ballasts and components to insure a QUIET fixture that will give you maximum lamp life and efficiency.

Each part is precision stamped from 20-gauge cold rolled steel or heavier to provide the sturdiest possible construction. All metal parts are thoroughly processed, and evenly baked in conveyorized oven to insure a uniform quality high-baked enamel finish.

The Highlander incorporates the same HIGH QUALITY, ENGINEERING FEATURES and WORKMANSHIP that has always been associated with Gibson fixtures.

Will Also be Available in the New 425 Milliampere, 48 inch.

Gibson MANUFACTURING CO. ATLANTA, GA.

The South's Finest

EASY TO INSTALL AND SERVICE . . . like all Gibson fixtures, the Highlander is easy to install. The same #100 continuous single stem set and #200 Dual Stem Set are adaptable to the new Highlander.

The fixture is quickly accessible for cleaning, relamping and maintenance. Pressure on a latch drops the louver assembly and opens the wiring channel for relamping and service. Where desired, the entire louver assembly can be removed by simply lifting the louver from the carrier straps.

We unhesitatingly urge you to compare: 1. Beauty 2. Efficiency 3. Installation 4. Maintenance and service features 5. Quality of materials and 6. Workmanship of the Highlander with that of any other fixture regardless of price. We believe you will agree that the Highlander is the greatest value on the market today.

FOR FULL DETAILS *Mail Coupon Today*

SEND COUPON NOW!

Gibson Manufacturing Co. EC&M
1919 Piedmont Circle, N. E., Atlanta, Ga.

Gentlemen: Please send me FULL DETAILS and PRICES on the new Gibson "HIGHLANDER".

COMPANY NAME_____

ADDRESS_____

CITY & STATE_____

INDIVIDUAL'S NAME_____

JOB RECORDS SHOW

Top Performance

with **TOLEDO SIMPACT**

Finest of all SELF-CONTAINED 1" to 2" THREADING TOOLS

You can do the job in a jiffy with a Toledo Simpact—a great tool for all-around use!

It's self-contained . . . one set of high speed steel dies for four pipe sizes, 1" to 2" pipe . . . sizes changed in a matter of seconds . . . extremely easy to operate . . . produces accurate leak-proof threads. Has few moving parts . . . light in weight . . . strong and sturdy. Dies can be reground when dull. 3-jaw pipe holder is designed for easy handling and accurate centering. Handle 24" long. Amazingly compact—the Simpact will thread a pipe projecting through a wall as short as 6¼". Weight complete only 20¼ lb. See it—try it—compare. Ask your Toledo supply distributor, or write for catalog. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

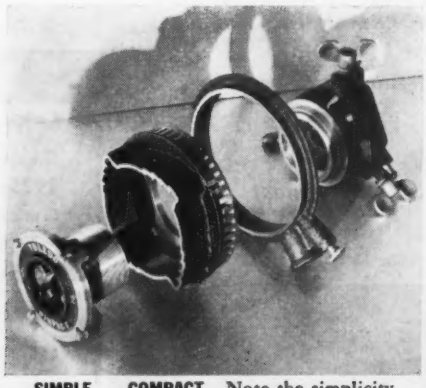
RELY ON THE LEADER

TOLEDO

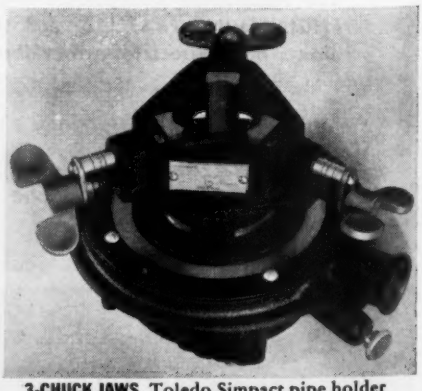
FOR PRECISION PIPE TOOLS

AUTOMATIC DRIP OILING. Oil pockets in head of a Toledo Simpact collect oil and drip directly on dies.

SIZES CHANGED INSTANTLY. Simpact dies are changed from one size to another easily and quickly. Positive, practical die setting.



SIMPLE . . . COMPACT. Note the simplicity of the Toledo Simpact. No complicated cam parts to clog with dirt and wear.



3-CHUCK JAWS. Toledo Simpact pipe holder with 3-chuck jaws is strong, easy to center, has powerful grip.

CRESCENT
IMPERVEX TRENCHWIRE

For Lowest Cost Underground Use

● CRESCENT IMPERVEX TRENCHWIRE provides the LOWEST COST, PERMANENT underground installation for services from power line to meter, for connecting several buildings from the same service, as on FARMS, ESTATES and INSTITUTIONS and for STREET, AIRPORT, BALL PARK, DRIVE-IN THEATRES, and other outdoor lighting and power circuits. Also extensively used by INDUSTRY in ducts for underground power circuits.

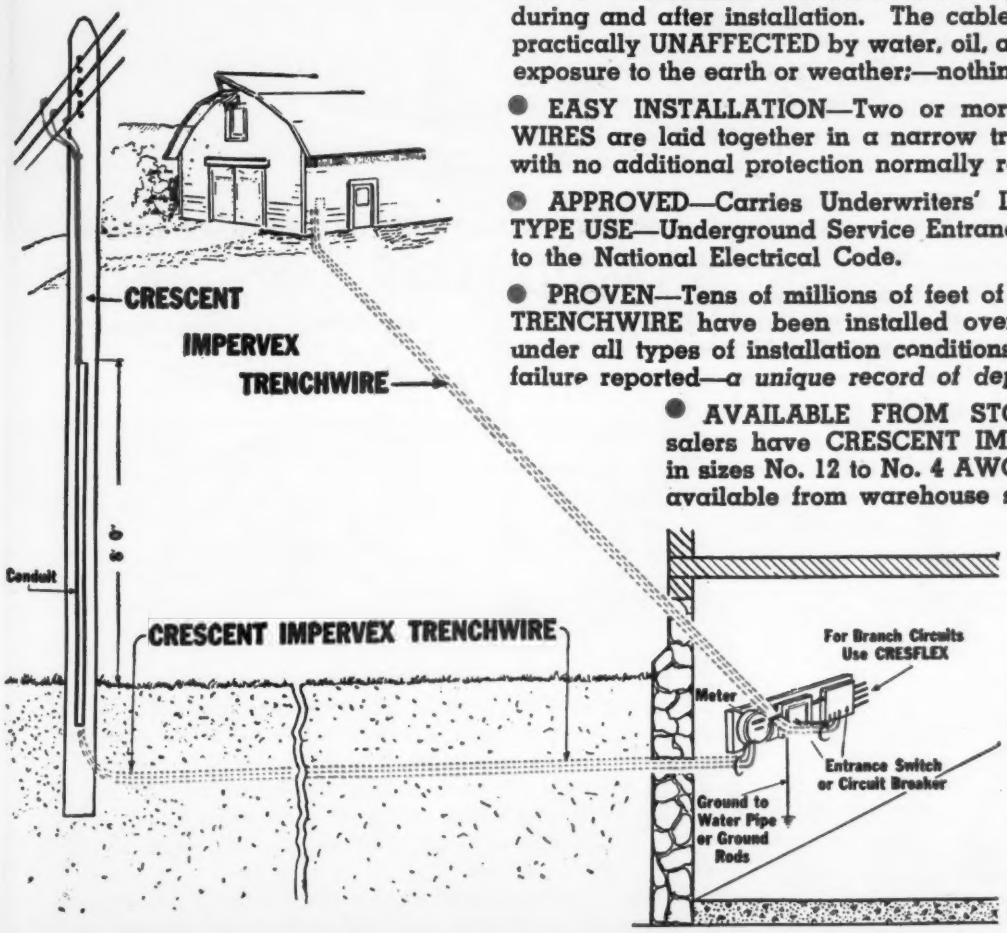
● CONSTRUCTION—The single copper conductor is insulated with IMPERVEX special moisture and heat-resisting rubber insulation. A tough NEOPRENE armor sheath is vulcanized over the insulation, protecting it from injury during and after installation. The cable is flame-retarding and practically UNAFFECTED by water, oil, acid, alkali, sunlight and exposure to the earth or weather;—nothing to rot, rust or corrode.

● EASY INSTALLATION—Two or more IMPERVEX TRENCHWIRES are laid together in a narrow trench to form the cable with no additional protection normally required.

● APPROVED—Carries Underwriters' Laboratories' Labels as TYPE USE—Underground Service Entrance Cable, and conforms to the National Electrical Code.

● PROVEN—Tens of millions of feet of CRESCENT IMPERVEX TRENCHWIRE have been installed over the last seven years under all types of installation conditions, with not one case of failure reported—*a unique record of dependability!*

● AVAILABLE FROM STOCK—Electrical wholesalers have CRESCENT IMPERVEX TRENCHWIRE in sizes No. 12 to No. 4 AWG in stock. Larger sizes available from warehouse stocks or the factory.



● BULLETIN No. 451 giving technical information on selection of proper size of conductor, etc. will be furnished on request.

CRESCENT
WIRE & CABLE
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

LOUVERLITE

SLIMLINE

by Smithcraft

A PROGRESSIVE DEVELOPMENT IN LOUVERED LIGHTING

A FOLDER "LOUVERLITE SLIMLINE" IS AVAILABLE UPON REQUEST. WRITE FOR YOUR COPY TODAY!

Smithcraft
LIGHTING DIVISION
CHELSEA 50, MASSACHUSETTS

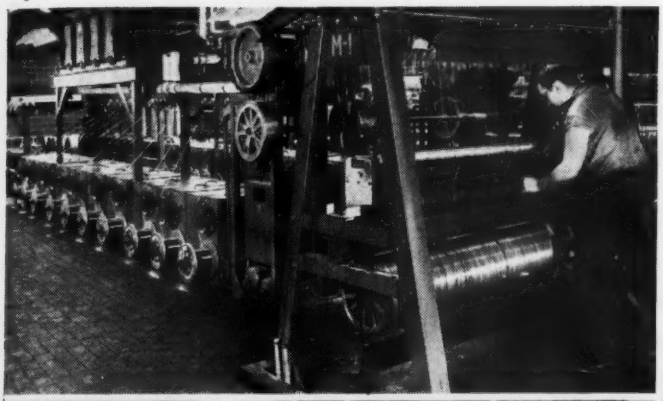
Louverlite Slimline, truly a progressive development in louvered lighting, utilizes the Smithcraft "area-of-light source" principle to create an extremely shallow and unobtrusive fixture. Designed for two or four T-12 or T-8 96" Slimline lamps, Louverlite Slimline provides an excellent downward component of glare-free light, with an effective louver cut-off of 30° crosswise, 30° lengthwise.

Louverlite Slimline may be mounted surface or pendant, individually or continuous row. Installation and maintenance are effectively simplified. The rigid louver is held by Smithcraft Duo-Cam hangers, and relamping can be easily accomplished by finger-tip release of the louver, from a single position. For servicing, the louver hinges from either side and can be removed without involving tools or loose parts.

Louverlite Slimline is a notable achievement in the design of fluorescent lighting elements . . . a proud addition to the Smithcraft line of "America's finest fluorescent fixtures".

New Plant TO MEET DEMAND

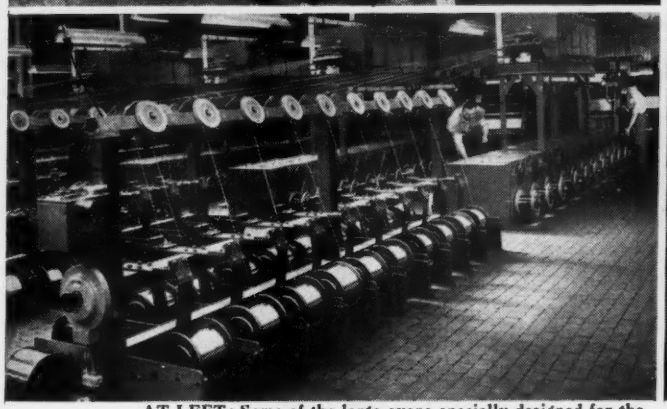
ROEBLING ROEVAR MAGNET WIRE

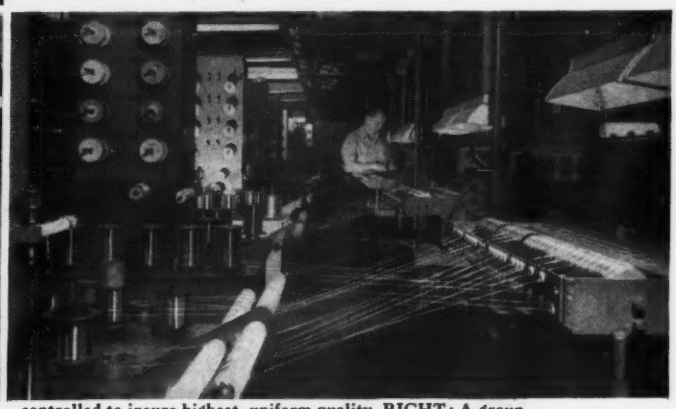


NOW IT'S IN FULL SWING . . . the most modern, precision-equipped magnet wire plant in the world. And it's fair to say that *customers* built this new plant. It *had* to be built to meet the increased demand for Roebling Magnet Wire.

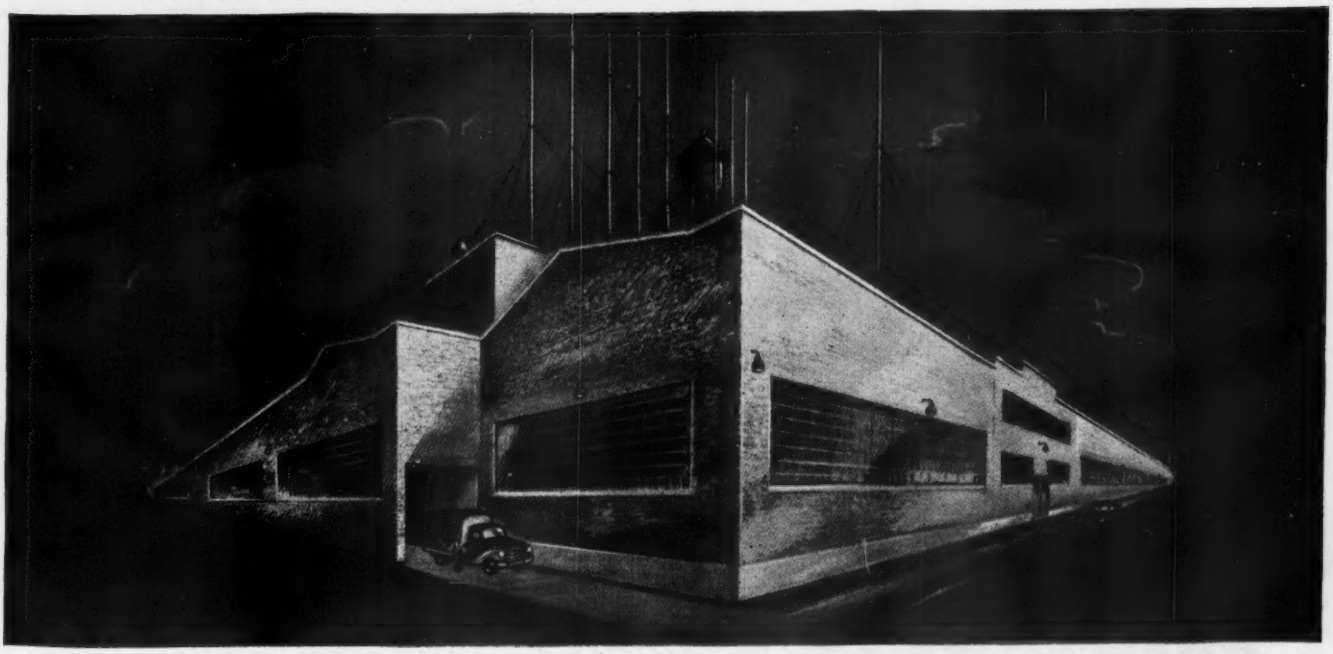
Roebling Roevar Magnet Wire is your best choice for high-speed winding . . . its insulation is 10 to 40 times tougher than conventional enamel. Roebling Roevar also has a better space factor and costs less. But whatever your special requirements, Roebling can meet them with cotton, Roeglas, paper and other insulations of topmost quality.

Write for full data and samples. John A. Roebling's Sons Company, Trenton 2, New Jersey.





AT LEFT: Some of the large ovens specially designed for the production of Roebling Roevar and Roebling enamel magnet wires. Composed of a pre-annealer, enamelling oven, and individual take-up equipment, they are electrically equipped and controlled to insure highest, uniform quality. RIGHT: A group of seven small enamelling ovens located in a special department for producing Roebling Roevar and Roebling Enamel Magnet Wire in the finer sizes.



FOR OTHER ROEBLING ELECTRICAL WIRE AND CABLE
WRITE NEAREST ROEBLING OFFICE FOR NAME OF YOUR DISTRIBUTOR

Atlanta, 934 Avon Ave. ★ ***Boston,*** 51 Sleeper St. ★ ***Chicago,*** 5525 W. Roosevelt Rd. ★ ***Cleveland,*** 701 St. Clair Ave., N. E. ★ ***Denver,*** 1635 17th St. ★ ***Houston,*** 6216 Navigation Blvd. ★ ***Los Angeles,*** 216 S. Alameda St. ★ ***New York,*** 19 Rector St. ★ ***Philadelphia,*** 12 S. 12th St. ★ ***Pittsburgh,*** 855 W. North Ave. ★ ***Portland, Ore.,*** 1032 N. W. 14th Ave. ★ ***San Francisco,*** 1740 17th St. ★ ***Seattle,*** 900 First Ave. So.

ROEBLING

A CENTURY OF CONFIDENCE

BECAUSE they don't rot.. .... FIBERGLAS* Yarns

In rip cords for nonmetallic-sheathed building cable, Fiberglas yarns possess extremely high tensile strength.

The Fiberglas yarns used in these braids are not only rot-resistant but flame-resistant, moisture-resistant, and corrosion-resistant as well.

OWENS-CORNING FIBERGLAS Yarns

*Fiberglas is the trade-mark (Registered U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

ARE WORTH LOOKING FOR IN BUILDING WIRE AND CABLE YOU INSTALL

Fiberglas glass yarns . . . used in both nonmetallic-sheathed building cable and rubber-covered building wire . . . *don't rot . . . don't absorb moisture . . . don't burn. They do resist corrosion.* Result—Fiberglas yarns have long life, really long life.

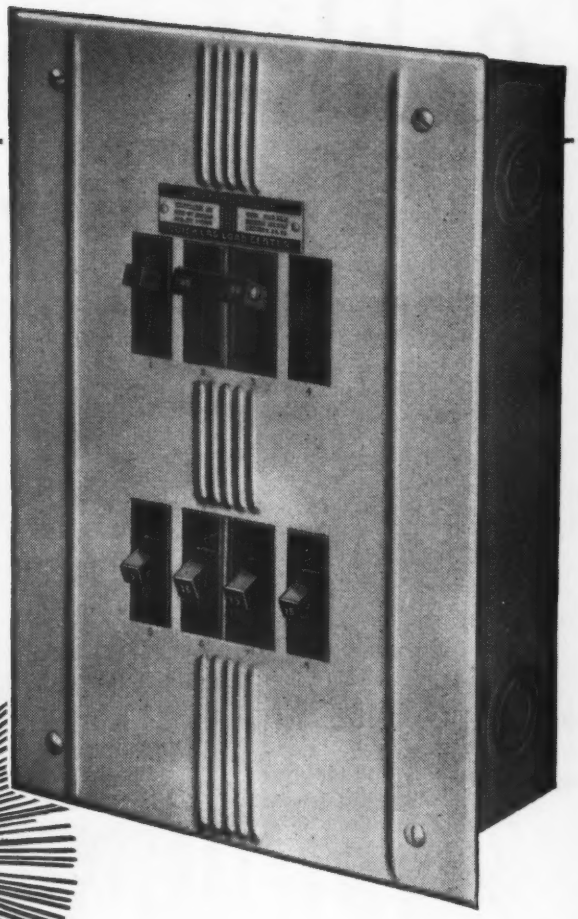
Long life is a good property to have in materials used to make building wire and cable you install. *Especially when you don't have to pay a premium for it!*

Fiberglas yarns also provide high impact strength, and have high tensile strength combined with low build-up. They make it possible to produce rubber-covered building wire that is strong and small in diameter, and which can be easily pulled through conduits.

Our new catalog of Fiberglas glass-base electrical insulating materials has a section devoted to wire and cable insulation. Send for it. Owens-Corning Fiberglas Corporation, Textile Products Division, Dept. 856, 16 East 56th St., N. Y. 22.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



WHY GROPE?

...Just flip the switch

Contractors and homeowners alike prefer Westinghouse Quicklag Load Centers . . . and for good reasons. Homeowners like the convenience of no fuses to replace . . . nothing to buy. There's no more groping in the basement. Quicklags may be installed anywhere that's convenient. When the lights go out, a "flip of the switch" restores service —it's as simple as that.

Contractors like them because they may be tailored to fit any circuit requirements . . . on the job. It's easy to pick the correct breakers from a minimum supply of basic components . . . and snap them into position.

And, what's more, Quicklags offer sure protection for circuit wiring. Their combined thermal magnetic action assures positive circuit protection against dangerous overloads or short circuits.

Get complete information today. Call your nearest Westinghouse Sales Office, or write for Bulletin B-3881. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-30006

Westinghouse

QUICKLAG
LOAD CENTERS

Cables run COOLER...
in TRANSITE DUCTS

. . . reducing copper losses
. . . increasing current capacity
. . . prolonging insulation life

YOU REDUCE copper losses . . . increase current carrying capacity . . . and prolong insulation life, when you run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 290, New York 16, N. Y.

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV
(6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%
Earth Temp. ambient—20 C

	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric loss (C)	1.9	2.1
Allowable Rise for Copper loss (C)	59.1	58.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365.
Allowable Current—(Relative %)	105.6	1.00.

Johns-Manville *Transite Ducts*

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

Electro

★ Commercial
★ Industrial
★ School
★ Troffer
★ Residential
★ Portable

Fluorescent

★THE RIGHT LIGHT FOR EVERY PURPOSE

SKYLOUVER
TWENTY-TWENTY
A FLEUR-O-LIER
Certified FLEUR-O-LIER
CERTIFIED in accordance with Test Requirements of Specifications of Fleur-O-Lier Manufacturers
ELECTRICAL TESTING LABORATORIES, INC. NEW YORK 6, N. Y.
MANUFACTURER
SKYLINER
ALL ELECTRO FIXTURES
bear the Underwriters' Laboratory Label, the I. B. E. W. and A. F. of L. Union Label, and ELECTRO'S unconditional guarantee for workmanship and performance.
RECESSED TROFFERS
INDUSTRIALS

● **SKYLOUVER**—available in 2-40W, 3-40W and 4-40W Louver or glass bottom. For individual and continuous installation, surface or pendant mounting. Exceptionally shallow—only 5⅛". Hinged Louver or glass panels provide easy, low-cost maintenance. Louvers and side panels of moulded plastic Polystyrene. Glass bottom panels of ribbed Skytex glass. Model No. 1025 2-40W— Model No. 1035 3-40W—Model No. 1045 4-40W **with Louvers**... Model No. 1026 2-40W—Model No. 1036—3-40W—Model No. 1046 **with Glass.**

● **TWENTY-TWENTY 2-40W** for schools, offices, hospitals, banks, stores, restaurants, etc. Louver panel in one complete section—hinges from either side permitting low-cost, easy maintenance. Individual or continuous—pendant or surface mounting. Safe—all steel construction. Model No. 2020.

● **AVAILABLE** in two and four light open luminaires, surface, and pendant mounted continuous and individual installations. Wafer-thin lending to modern streamline design. Starters easily accessible for ease of maintenance. Incorporates new ELECTRO Speedy Hanger. Model No. 1044.

● **COMPLETE LINE OF RECESSED TROFFERS**—regular fluorescent and Slimline (T8 and T12 bulbs), 20, 30, and 40 watt, one lamp, two lamp, three lamp, and four lamp. Open, louvered, and glass bottom. Can be mounted overhead, T-bar, and Universal. In line and corner spot lite boxes available for all units. Louver and glass bottoms hinge downward for ease of maintenance. Hangers permit adjustment of fixtures to all types of ceilings.

● **COMPLETE INDUSTRIAL LINE** including synthetic and porcelain enamel open and closed end reflectors. Available in two and three lamp 40 watt and two lamp 85 watt; four foot and eight foot sections. Also Slimline Industrials and Instant-Start Fluorescents.

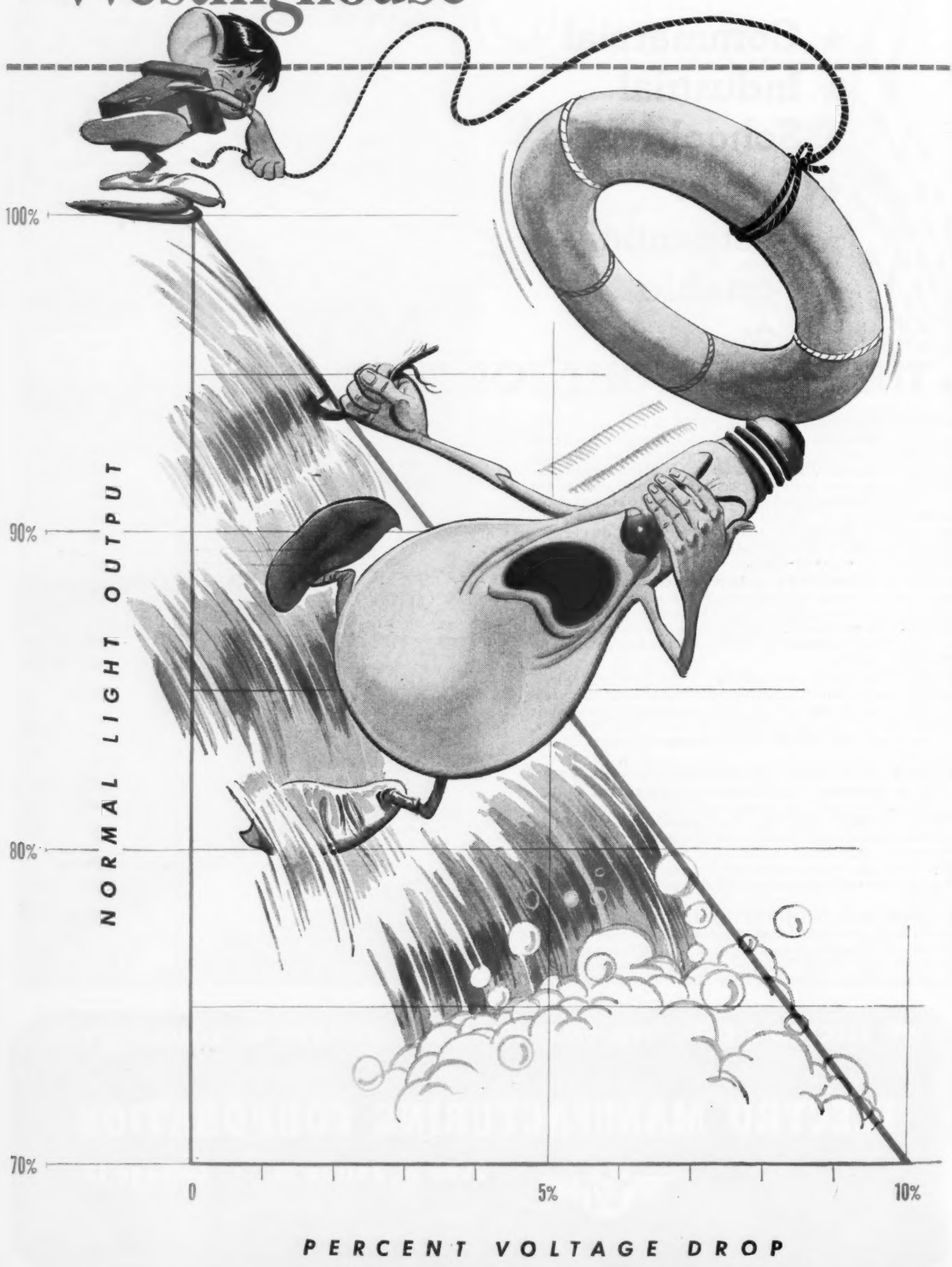
ELECTRO'S LIGHTING ENGINEERS ARE ALWAYS AT YOUR SERVICE

ELECTRO MANUFACTURING CORPORATION

2000 W. Fulton St. • Chicago 12

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Apply the SURE CURE for Fading Lights!

Lights go dim? Blink?

When you aren't getting the light you require, in spite of a well-planned lighting system, it's often a sign of undervoltage, the inevitable result of growing or changing loads that tax existing circuits. Correct this quickly, economically.

APPLY THE *SURE CURE:* Bring high-voltage power close to load centers with Westinghouse Dry-Type Transformers.

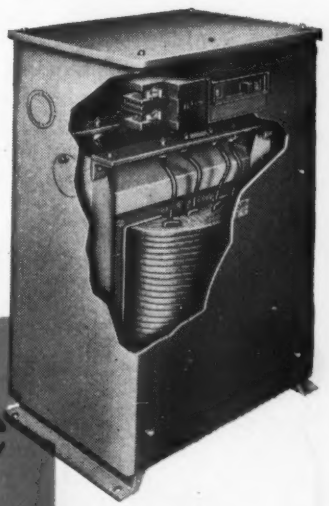
Overextended or overloaded lines cause voltage to drop. A loss of only 10 volts in a 120-volt circuit cuts incandescent light output 25%, makes fluorescents dim and often unstable. Motors, heating equipment and other electrical apparatus lose proportionately. But taking high-voltage power close to secondary loads reduces voltage drop and minimizes power losses.

Because Westinghouse Dry-Type Transformers are smaller and lighter, they can be installed easily. There is no need for fireproof vaults—mount them overhead, on shelves, posts or platforms. Welded sheet steel cases completely enclose the transformer for safety and a trim appearance.

You can be sure of effective correction of overloaded circuits with Westinghouse Dry-Type Transformers. For complete information, write for Booklet B-4009. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-70534

NOW AVAILABLE WITH BUILT-IN CIRCUIT BREAKER

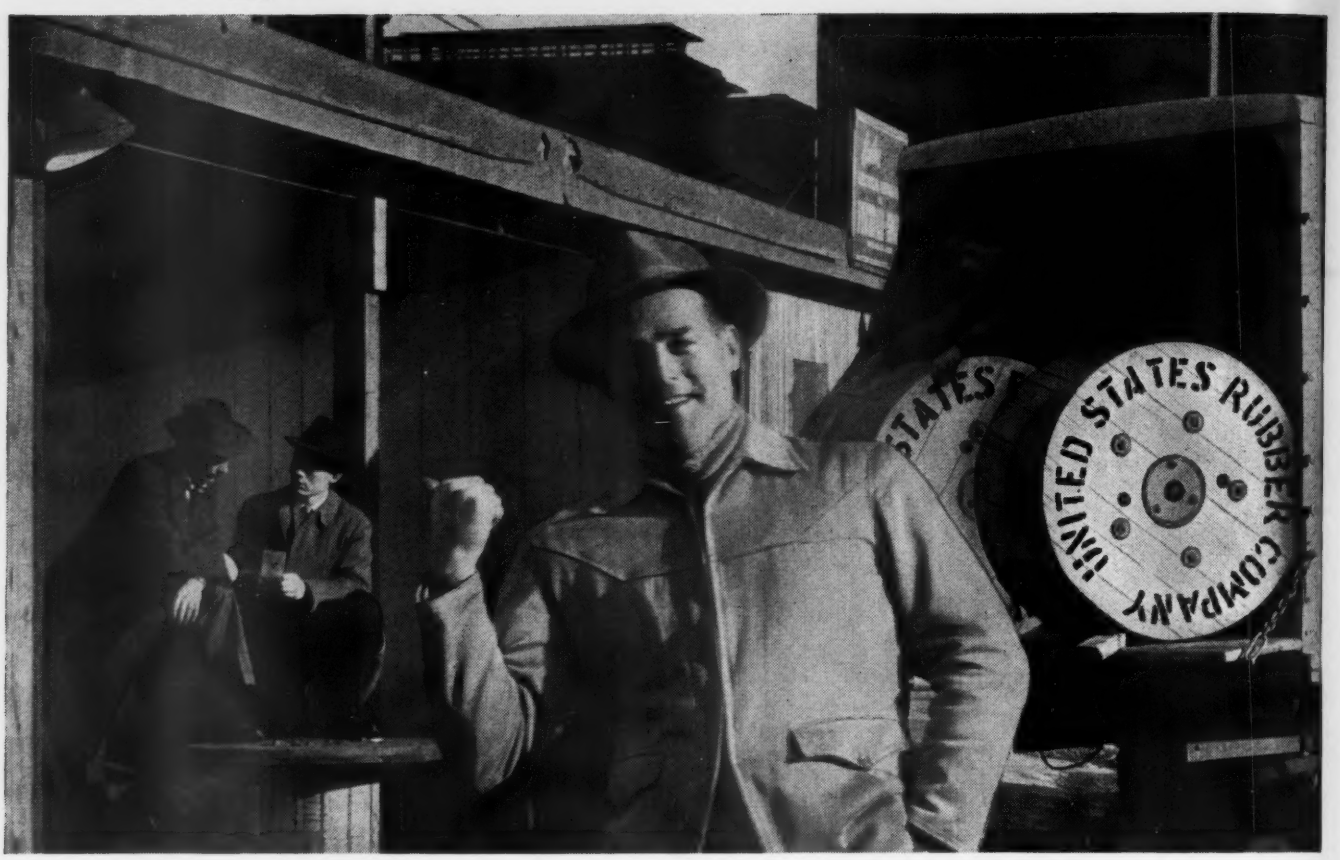
New Types AJRB and AVRB give you a transformer and circuit breaker in a single, compact package. The need for separate protective devices is eliminated.



WESTINGHOUSE

Westinghouse

DRY TYPE TRANSFORMERS



"*This Pair* saved me money on wire!"

That's the kind of talk you hear from an electrical contractor—when he deals with U. S. Rubber.

For the U. S. Rubber salesman teams up with the U. S. Distributor's salesman—to make sure you get the *right* kind of product . . . at the *right* time.

Your crews won't stand idle awaiting electrical wire shipments, when this team is working for you. They'll get you the stuff on time, because they have it stocked close to you.

And if you have an extra rush-rush order, or one that's hard to fill, you'll be surprised how quickly they can deliver it.

But the most important money-saving function of this "U. S." team is the quality of the product they bring to you. They provide such items as U. S. Laytex, the small diameter wire that enables you to take out 6 wires and put in 11 in the same conduit on rewiring jobs. This extra quality wire costs no more than ordinary code wire. Then there's Laytex RUW, the wire with unsurpassed insulation resistance in wet locations . . . U. S. Service Entrance Cables, the first ever approved by Underwriters' Laboratories with Neoprene cover and Laytex insulation.

Get together with the U. S. Rubber Salesman and the U. S. Rubber Distributor. You'll save money, every time.

U. S. ELECTRICAL WIRES AND CABLES FOR EVERY PURPOSE

The electrical wholesaler performs an indispensable function in distributing electrical products. He keeps inventories, provides billing, credit and other services—each of which reduces the cost of the electrical product to the contractor.

MADE ONLY BY

U.S.RUBBER

SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

Only FLEUR-O-LIER gives ALL these advantages:

★ Fleur-O-Lier Index System Rating

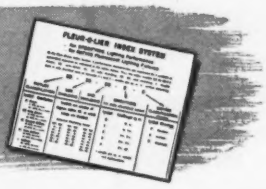
★ Photometric Data

★ Coefficients of Utilization Charts

★ Certification

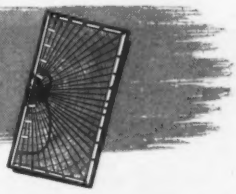
MORE AND MORE architects, utility lighting men and contractors are recommending Fleur-O-Lier labeled fixtures because only with Fleur-O-Lier certified fixtures do they get *all* "the facts of light" that enable them to get the most fixtures for their money.

★1



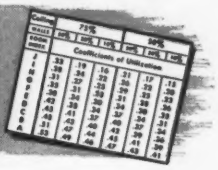
Every Fleur-O-Lier fixture is rated on the Fleur-O-Lier Index System to show its tested illuminating performance.

★2



Complete photometric data, as found by Electrical Testing Laboratories, Inc., is provided.

★3

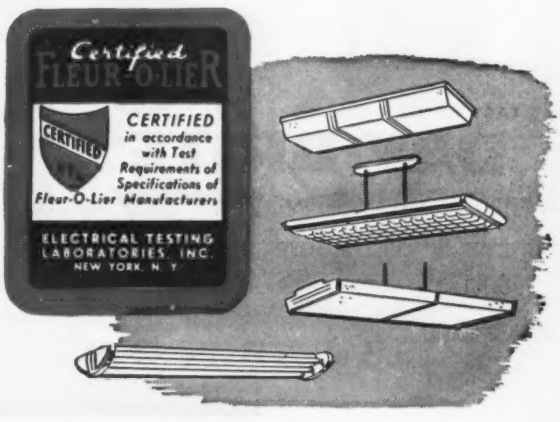


Coefficients of utilization charts, compiled by Electrical Testing Laboratories, Inc., enable the buyer to select the most suitable fixture for his installation.

★4

Certification, backed by Electrical Testing Laboratories, Inc., tests, is the buyer's assurance that the fixtures were made to rigid specifications covering electrical and mechanical features.

Specifiers and buyers are now insisting, "Be sure the fixtures bear the Fleur-O-Lier label!"



FLEUR·O·LIER

Manufacturers

2116 Keith Building • Cleveland 15, Ohio

Fleur-O-Lier is not the name of an individual manufacturer, but of a group of fixtures made by leading manufacturers. Participation in the Fleur-O-Lier program is open to any manufacturer who complies with Fleur-O-Lier requirements.

THE QUALITY PRODUCT PARADE

THERE'S MORE PROFIT FOR YOU...

WHEN YOU SPECIFY EASY-TO-INSTALL DAY-BRITE FIXTURES

Boost your profits with Day-Brite!

How! Why! Because Day-Brite means quick, easy installation . . . *less labor cost to figure.*

No matter which of the complete line of top quality Day-Brite fluorescent fixtures you install, you benefit from carefully engineered, *built-in* installation features. Plenty of knockouts . . . self-bushed wire feed holes . . . sturdy construction.

And when you leave a Day-Brite installation with your customer, you deliver years of trouble-free performance and low-cost, easy maintenance.

TODAY—write for the Day-Brite catalog . . . your first step to more profits.

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

IT'S EASY TO SEE WHEN IT'S

DAY-BRITE *Lighting*

DISTRIBUTED NATIONALLY BY LEADING ELECTRICAL WHOLESALERS

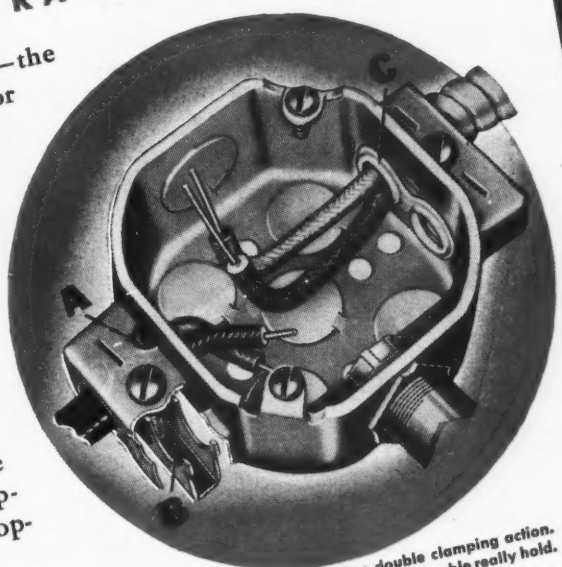
*®

The Spotlight's on Jay-Kay*

THE ALL-PURPOSE CABLE BOX—NEWEST IN THE COMPLETE RACO LINE!

Here's the all-purpose cable box—the RACO "Jay-Kay." Use it with BX or with Flex, or with Pipe and BX or Flex. Unique knockout design allows it to handle either BX or Flex quickly and easily. External clamps leave more room for stuffing wires—nothing has been overlooked in making this box the best bet for faster installation . . . saving labor.

The "Jay-Kay" Box is available NOW—for immediate shipment. It's the very latest development in cable boxes . . .



A The New "Jay-Kay" has double clamping action. The three pressure points on each cable really hold.

B Peepholes for the inspector. The red bushing is readily visible.

C The elongated knockout has two bushed holes for BX. The knockout is easily removed to provide a clear opening for Flex.

TRY THE "JAY-KAY" ON YOUR NEXT JOB

"Jay-Kay" Boxes also furnished on Bar Hangers:

HD Deep Offset

HS Shallow Offset

HSS ¾" Offset

*Registered Trade Mark

RACO

ALL-STEEL PRODUCTS

ALL-STEEL EQUIPMENT Inc.—800 Kensington Ave., Aurora, Illinois

"A BOX FOR EVERY NEED"

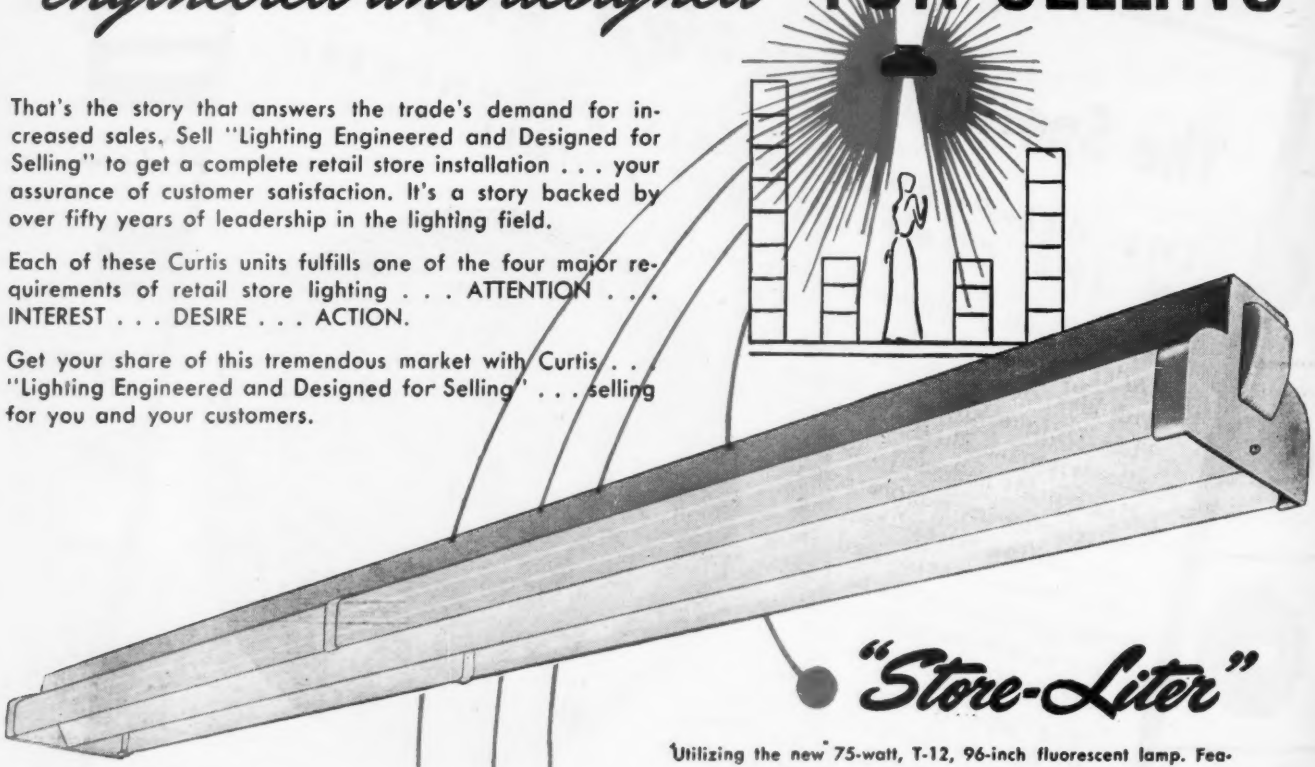
Curtis LIGHTING

engineered and designed FOR SELLING

That's the story that answers the trade's demand for increased sales. Sell "Lighting Engineered and Designed for Selling" to get a complete retail store installation . . . your assurance of customer satisfaction. It's a story backed by over fifty years of leadership in the lighting field.

Each of these Curtis units fulfills one of the four major requirements of retail store lighting . . . ATTENTION . . . INTEREST . . . DESIRE . . . ACTION.

Get your share of this tremendous market with Curtis . . . "Lighting Engineered and Designed for Selling" . . . selling for you and your customers.

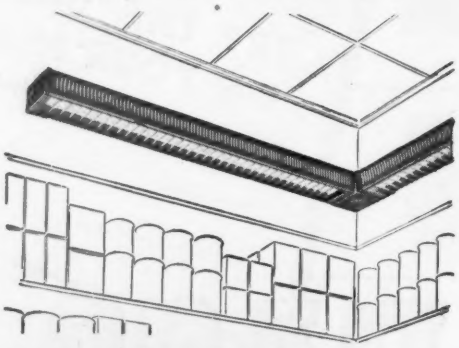


"Store-Liter"

Utilizing the new 75-watt, T-12, 96-inch fluorescent lamp. Features instant starting . . . more lumens per foot of lamp . . . 96-inches of uninterrupted light per luminaire. For general store illumination, it literally "washes the walls with light".

"X-Ray"

Silver-mirrored show-window reflectors for incandescent lamps. Three types: distributing, semi-concentrating, and concentrating. Creates "Attraction-Zone" lighting. Attracts more customers to merchandise displays.



"Wall-Strip"

Utilizing one 40-watt, T-12, 48-inch fluorescent lamp. Illuminates shelves, wall cases, etc., also directs some of its output to the ceiling where it is diffused into the sales area. Mounts to wall as individual unit or continuous run.

"Punchy"

Utilizing one side-prong PAR-38, 150-watt projector flood or spot lamp. Adjustable from the floor to any angle 0° to 35° from vertical and 0° to 360° horizontal. Puts lighting emphasis where it is wanted.

CURTIS LIGHTING, INC.
6135 WEST 65th STREET, CHICAGO 38, ILLINOIS
CHICAGO . . TORONTO . . NEW YORK

NEW...

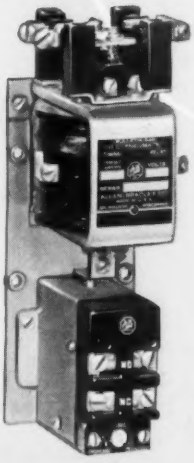
Bulletin 849

PNEUMATIC TIMING RELAY

Good for Millions of Operations

Timing Range from 10 cycles to 3 min.

A-C Timer with Auxiliary Contacts



D-C Timer

- FOR "DASH UP" OR "DASH DOWN" OPERATION
- AVAILABLE FOR NEMA TYPE 1, 4, 7, and 9 APPLICATIONS

This new, compact, solenoid type, pneumatic timing relay utilizes a synthetic rubber bellows for controlling the tripping time. Has a range of from 10 cycles to 3 minutes, and an accuracy of approximately ±10%. Its setting is easily adjustable over a wide range, and the relay resets instantaneously. This timer will provide satisfactory operation irrespective of temperature, humidity, or vibration conditions. Available with quick make and quick break, double pole, silver alloy main contacts—one set normally open and one set normally closed. Terminals are readily accessible from the front. A duplicate set of contacts for pilot control can also be provided, actuated directly from the solenoid. The unit can be readily changed from "dash up" to "dash down" operation by simply inverting the solenoid. Write for information on this new Bulletin 849 Pneumatic Timing Relay.

ALLEN-BRADLEY CO.
1316 S. Second St., Milwaukee 4, Wis.

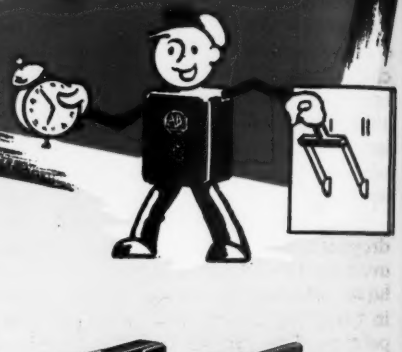
ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

A-B Quality

OTHER RELIABLE TIMING RELAYS

TO FIT YOUR REQUIREMENTS

A-B Quality

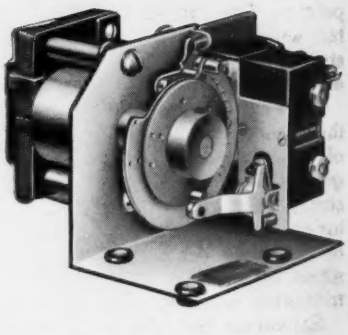


BULLETIN 850
MOTOR DRIVEN TIMING RELAY

Designed for timing comparatively long intervals with a high degree of accuracy where high speed recycling is not required. Furnished in several ranges with a maximum time delay of from 1 to 15 minutes. Variations in time between successive operations are less than 1% of the full scale range. Its synchronous motor is suitable for a-c pilot control service only. Has a single pole switch for normally open or normally closed operations.

BULLETIN 850
TYPE L LAUNDRY TIMER

Similar in design to the Bulletin 850 Motor Driven Timing Relay, this timer is specially designed for controlling washing machines and other equipment where the motor is run for a given period in one direction, reversed, and then run in the opposite direction.



BULLETIN 852
ELECTRONIC TIMING RELAY

Designed primarily for exact timing in frequent operation. It has a range of 20 to 1 and is provided in eight timing ranges with from ½ second up to 2 minutes maximum time delay. The reset time is approximately one-tenth of the maximum time delay. This is a flexible timer that can be recycled rapidly over long periods. Furnished with two normally open, two normally closed, or one normally open and one normally closed contacts.

BULLETIN 848
FLUID DASHPOT TIMING RELAY

Here is a magnetic type timing relay that combines simplicity, dependability, and low cost. It can be used in many applications where reliability is more important than exactness of timing. Operates at ambient temperatures from +120 F to −30 F without undue variations in timing. Has an adjustable range from 2 to 20 seconds and is available for a.c. or d.c. . . . in single pole construction . . . with either normally open or normally closed contacts.

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MOTOR CONTROL

A-B Quality

Write for New Timer Bulletin

Allen-Bradley Co.,
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SEPTEMBER . . . . *at a Glance*

Volume or Profit?

The course of construction statistics as assembled by the Department of Commerce shows the dollar volume of construction in place following very closely on 1948. Predictions are still optimistic and the chances are that 1949 totals will wind up a little above last year. Since prices are down the physical volume of construction activity ought to surpass the 1948 totals.

The hectic first half of 1949 with dropping prices and the vast changeover in inventory practice seems to have affected electrical work mostly in bringing about much sharper competition. The almost forgotten evils of bid shopping are back with us and stories of bidding at cost or below are everywhere.

The optimistic construction outlook, the very evident construction needs of our cities and towns, and enormous government appropriations for construction gives the electrical contractor an almost fool-proof market on top of which is piled uncharted opportunities in lighting, rewiring and electrification work in existing structures.

Senseless bid chopping and price cutting can sour the best market opportunities. A business like concern for net return and hard headed restraint when shopping starts are essentials if we are to avoid a shopful of impressive but profitless volume.

Reader Service

Several of our regular departments have been rearranged and brought together under a new Reader Service section which begins in this issue. The change is made to enlarge the scope of our service and to make it easier and more convenient for you to get further information about new products, to obtain current manufacturer literature, to ask for authoritative answers to code problems, to ask or answer technical questions pertinent to electrical construction, installation or maintenance, to sound off on current controversies, to advise us on the kind of data you want or don't want or to tip us off to a project or job you think might be interesting or instructive to other folks in the industry. Altogether we are confident that "Reader Service" is going to be a thoroughly useful project. We'll be watching for your reactions.

Lighting Systems

Lighting systems are a logical development of planned lighting progress. The fixture as a basic element in lighting design is necessarily a component or a working unit of the total lighting system. This point of view so widely held today would have been considered revolutionary only a few years ago. It is clearly apparent, however, in the design and application trends of current planned lighting projects.

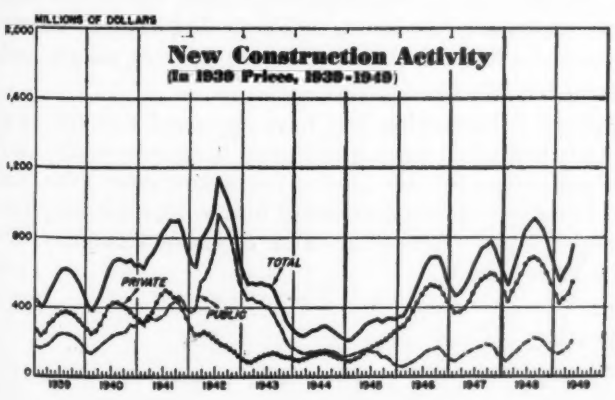
It is logical, therefore, to appraise and classify lighting equipment in terms of lighting systems as a guide to equipment selection. This type of classification forms the framework of our annual special editorial feature section on Planned Lighting, prepared by Berlon C. Cooper, beginning on page 73 of this issue. You'll find this a particularly useful guide for tackling the big fall lighting business.

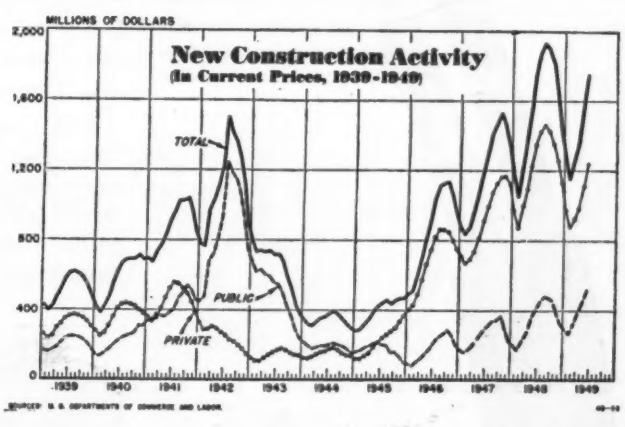
Apprenticeship

Ray Ashley's searching analysis of the cost of apprentice training, page 97, is a unique project important to every contractor in these days of acute cost-consciousness. It appears, incidentally, just as the McGraw-Hill Book Co., is announcing the publication of the long awaited "Electrical Estimating." In it Ashley has achieved a soundly practical work on a subject that has long needed an authoritative and comprehensive book that brings together the principles, methods, and data of modern electrical construction estimating.

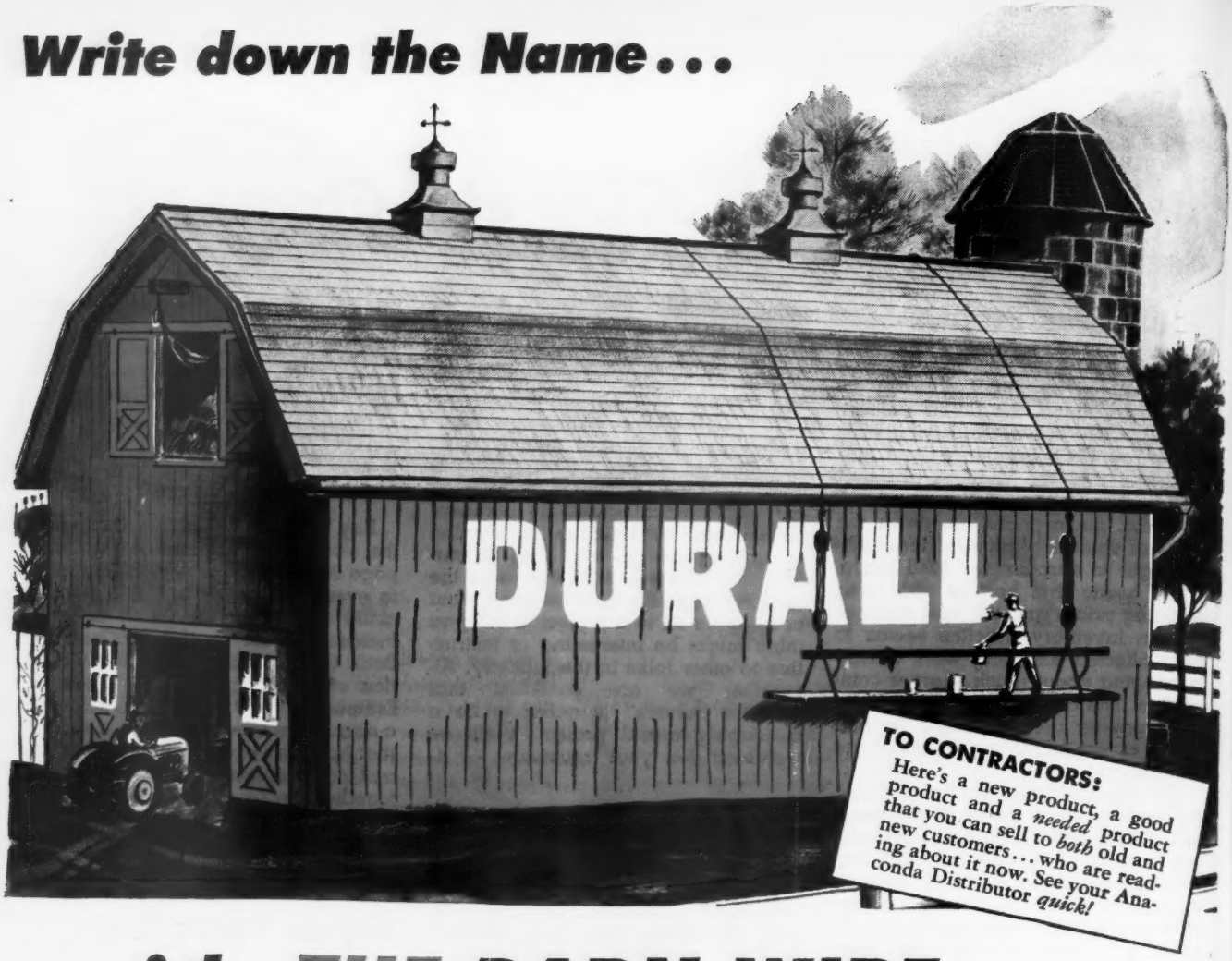
Higher Productivity

Economists point out that higher productivity and lower costs are the essence of industry's progress. Beginning next month you'll find a series of articles tagged with a small symbol carrying the phrase "Higher Productivity—Lower Costs" to emphasize the importance of constant effort toward that objective. The articles will carry in brief paragraphs on experience tested methods, in the shop, on the job and in the front office that help toward greater values, better efficiency and better cost control.





Write down the Name...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TO CONTRACTORS:
Here's a new product, a good product and a *needed* product that you can sell to *both* old and new customers... who are reading about it now. See your Anaconda Distributor *quick!*

...it's THE BARN WIRE

every farmer will want

Farmers *do* worry about barn wire. But they don't need to worry any longer, now that they can get Anaconda Durall Cable, the new, Underwriters approved, completely reliable barn wire.

Durall is a non-metallic-sheathed wire with a rubber-like insulation of Neoprene and a heavy protective jacket of the same tough, flame-resistant material . . . with no fibrous coverings to rot or fray.

Durall is strong electrically and physically. Both insulation and jacket are highly resistant to moisture, mold, rot and animal wastes. Durall will not support flame, is proof against most acids, alkalis and oils. This is a truly fungus-resistant cable.

The Underwriters' Laboratories, Inc. have approved DURALL as a "Non-metallic-sheathed cable having adequate fungus-resistant, and other necessary properties for use in cow barns and *other* locations where it would be subjected to conditions of heat, cold, moisture, corrosive fumes and fungus." Anaconda Wire & Cable Company, 25 Broadway, New York 4, N.Y.

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HOT EQUIPMENT

ONE OF THE MOST common reports on maintenance requisitions or shop calls is "motor running hot". Sometimes they turn out to be false alarms. During the dog-days a perfectly normal temperature rise under full load feels excessive to the heat-conscious machine operator. But usually heat in electrical equipment is a caution signal that cannot be too long ignored.

SUMMER HEAT provides high ambient temperatures. Normal temperature rise carries equipment under load up to relatively high levels. Borderline apparatus applications, too heavily loaded, or poorly ventilated sometimes give way. It is during such times that a good thermometer becomes an essential and highly informative tool of electrical maintenance. Equipment can, of course, be eased over the temperature humps by fans, load dumping or shutdown. But these are temporary expedients which should be followed by a full instrument check-up at the earliest opportunity.

SUCH CHECK-UPS are more informative if they are made during the operating shift. One of the most persistent causes of overheating is undervoltage which may not be apparent during shutdown hours. At 90 percent of rated voltage a polyphase induction motor under full load takes 11 percent more current and runs 6 to 7 C degrees hotter. When the undervoltage is an occasional condition brought about by varying loads served by the same feeder, the stage is set for overheating and even motor failure with no apparent cause.

HEAT IN SWITCHBOX, panels and controls is always an important warning. The resistance of poor contacts, loose lugs and the like, besides wasting good kilowatt hours, can introduce serious votage drop at times of high demand when rated voltage to handle full motor loads is most needed.

WHILE FULL EFFICIENCY is an ideal which can never be attained in practice, electrical equipment of good design, properly applied, and provided with stable voltage operates at very high efficiency. Losses, evident in the form of heat, are notably low. Overheating is a symptom of a let-down in efficiency which calls for analysis and correction even though the temperature involved may be far below any point of actual danger.

Wm. F. Stuart

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That's true whether you're installing light in plants, offices, stores, or out-of-doors. For Graybar has the biggest selection of lamps and lighting units available anywhere. Graybar Lighting Specialists have studied, planned, and supplied lighting systems of every conceivable type. That's why they can impartially recommend the best equipment for any illumination need. For an up-to-date guide in planning your lighting jobs, mail the coupon below.

Local Stocks of Lamps

Graybar distributes all types and sizes of G-E lamps — fluorescent, filament, mercury — clear, frosted, colored — glow lamps, heat lamps, germicidal lamps, flashlight lamps. Stocks are maintained at Graybar's more than 100 warehouses throughout the nation for prompt delivery anywhere.

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In addition to the materials needed for *any* lighting job, Graybar can provide all the tools and supplies for wiring, communication, ventilation, and other electrical installations. All are first-quality products of leading manufacturers.

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New York 17, N. Y.

Please send me free a copy of your 84-page book, "Planned Commercial Lighting."

Name_____ Title_____

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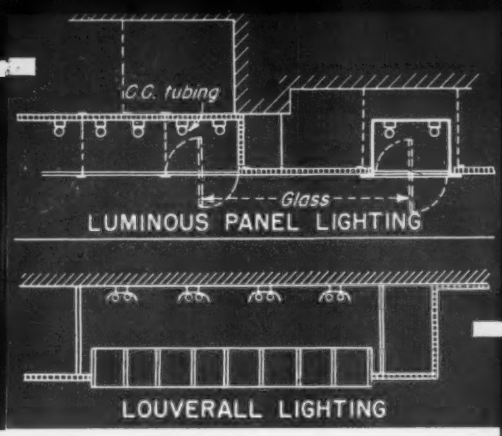
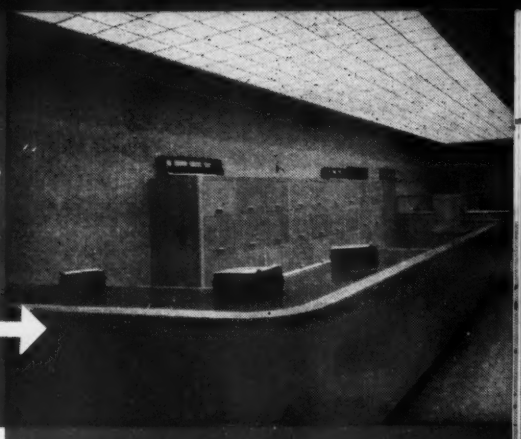


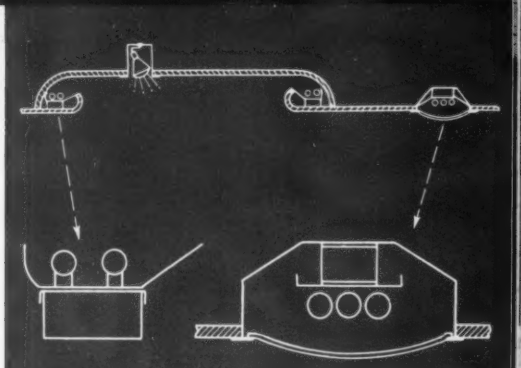


PLANNED LIGHTING SYSTEMS

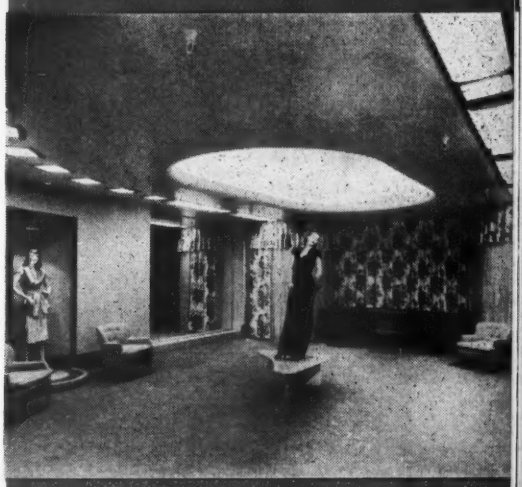
Commercial application of modern lighting technology is built up from a predetermined lighting effect or result. Specifications and layouts usually point to a family of lamp and luminaire designs. The family may consist of a finely coordinated group of units of the same manufacture. It might be individual units from several manufacturing sources which show qualities which are complementary or supplementary in a particularly useful way. In essence, however, each fixture is a working component of a lighting system.

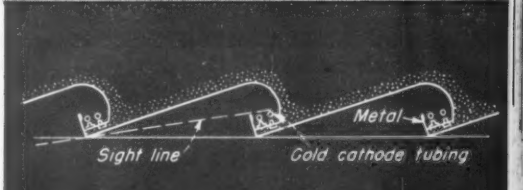
Fortunately, the trend toward integrated lighting systems based on predicted lighting results, has been closely paralleled by a development in sources, equipment and components. Modern planned lighting design is substantially a custom job, accurately fitted to purpose, needs, and surrounds. But with the present wealth of luminaire designs; lamps, reflectors, louvers and other components, such jobs are substantially an assembly of readily available, finely engineered, mass produced parts. The lighting results of fine, custom built and applied lighting are well within the area of normal commercial standards.

In view of current trends, lighting equipment falls into a broad classification by systems. It is the purpose of the following pages of this editorial feature section to provide a convenient and easy to apply basis for classification and appraisal of modern lighting equipment in current practical applications.

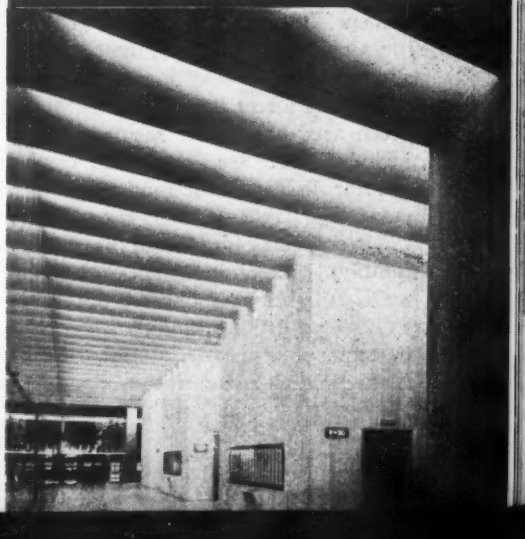


COVE AND TROFFER LIGHTING

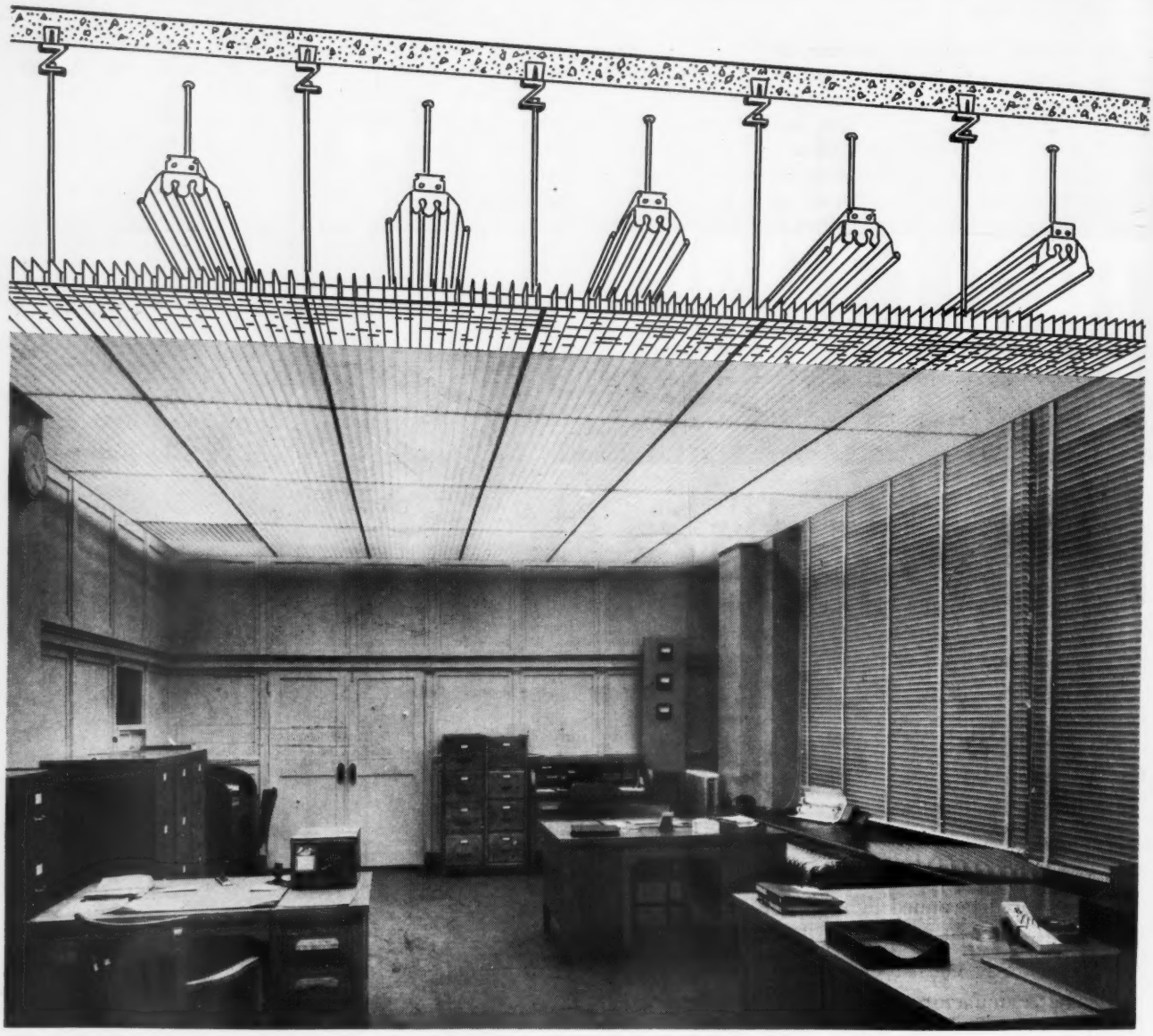




COVE LIGHTING WITH SERIES OF COVES



Louverall and Luminous Ceiling Lighting



LOUVERALL LIGHTING SYSTEMS provide a low brightness continuous plane source of light with lighting components installed above ceiling and adequately shielded. Diffusing panels may also be used in place of louver sections.

AN analysis of lighting techniques and applications in current use suggests classification according to *system*. Such classification is made here. Through this method of classification, it is possible to identify any one specific lighting unit, component, or piece of lighting equipment as belonging to one or more of the several types of lighting systems. This approach also provides a sound basis for comparison of one type of lighting (or lighting system) with another, and for selecting that lighting system which most adequately meets the specific lighting requirements for any given area or specific seeing problem. The classifications included here are limited to commercial and industrial interior lighting, but might equally well be expanded to cover other types of lighting.

Through classification of the various types of lighting into *lighting systems*, it becomes a relatively simple job to plan and sell lighting systems to the lighting customer, tailored to his own definite requirements. This is what the lighting customer is primarily interested in buying. He is interested in the complete lighting system, and in the final lighting result. He wants to know that the complete lighting system will provide the proper amount of illumination, of the proper quality, to best solve the lighting problems and seeing tasks in his own office, store, or industrial plant. He wants to know that the initial cost, and the annual, or operating cost of this tailored lighting system is economical, and that he is getting his money's worth based on what this lighting system will do for him in comparison with what some other lighting system would accomplish. He is less interested in the details of the many components which go to make up the complete lighting system, the "nut and bolt" problems of the lighting engineer and electrical contractor, other than to know that quality materials, and equipment designed for ease of maintenance, are used. He delegates the responsibility of the selection of these various components—light sources, luminaires, reflectors, wiring channels, louvers, diffusing media, etc.—and their method of installation to the architect, lighting engineer, and electrical contractor, all of whom are trained specialists in this field.

Illustrations are used freely throughout this presentation

to show visually, insofar as possible, the basic principles involved in each type of lighting system. The data are of necessity general, and include cross-sections of typical lighting equipment, reflector units and luminaires, and Coefficient of Utilization tables showing average values. The data are based on the Illuminating Engineering Society Lighting Handbook, various lighting equipment manufacturers' catalog data, illumination design data bulletins and handbooks published by the lamp manufacturers, and other reliable and authoritative sources.

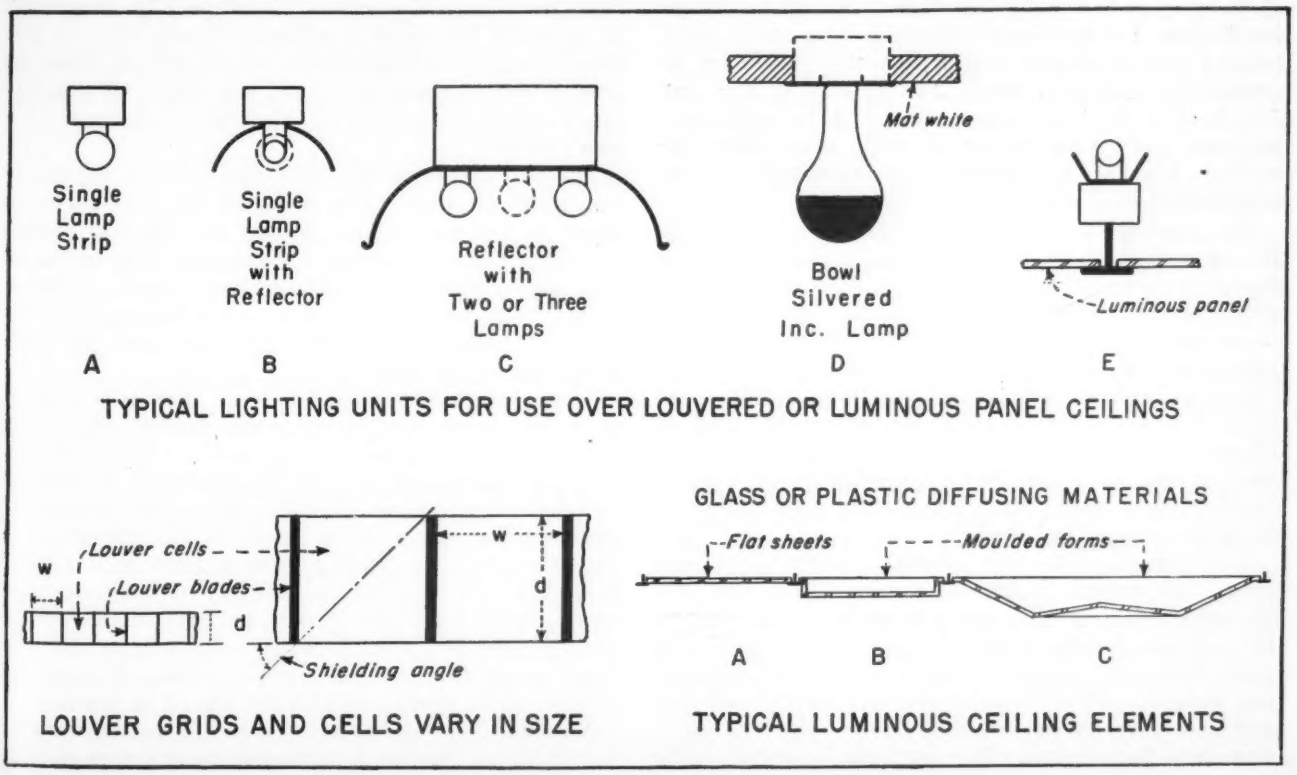
Architects and lighting engineers have for many years striven to provide an ideal artificial lighting system. The elements of such a system have been generally recognized and known. In such a system the lighting should be free from glare, both direct and reflected. It should be efficient, so that higher lighting intensities can be provided economically. The color, finish, and reflectances of ceilings, side walls, furniture and furnishings, and even of the floor, have been recognized as factors influencing the lighting environment, brightness ratios, and the final lighting result in each area to be lighted.

After fluorescent lamps became available, experiences with fluorescent luminaires using louvers or luminous elements to shield the lamps indicated that a continuous plane source of light having low brightness was both feasible and practical by using the new low brightness line source fluorescent lamps above large louver panels or translucent diffusing panels. Thus it was that the louvered ceiling, now popularly called *louverall*, and the luminous ceiling, was conceived and further developed.

Louverall and luminous ceiling lighting has created an ever-increasing interest in the last few years. The two types are combined for this discussion, since the basic principles of application and use are the same from the standpoint of system classification. Full size installations of both were made more than 15 years ago, using incandescent filament lamps. Introduction of fluorescent lamps in 1938 served to create still greater interest, and installation of still other permanent and experimental systems were made. Development has progressed over the past ten years to the extent that components of both louverall and luminous ceiling lighting systems are now manufactured on a standard production basis, and distributed and sold through normal distribution channels. Both have reached a fairly high level of refinement. However, research continues and further refinements may be expected in the years ahead. Efforts will be continued to provide a truly ideal artificial illumination environment and lighting result.

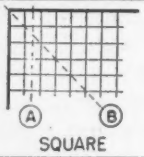
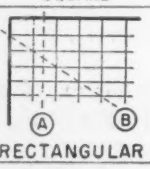
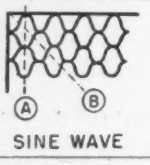
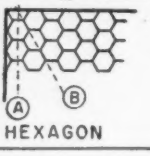
The now popular louverall lighting system consists essentially of a system of louvers covering all or a large part of the ceiling, shielding a system of fluorescent lamps which are installed over the louvers in a cavity which must be provided for. The function of the louvers is to shield the light sources in the cavity, and to prevent direct glare from the light sources. By finishing the louvers in a light color, they automatically reflect a portion of the light generated by the light sources above, and form a low brightness luminous element which serves as the ceiling.

Experimental and actual louverall lighting systems installed since 1945 have made use of louvers made of plastics, steel, aluminum, wood and paper. These have involved a variety of cell pattern designs, including circular, sine wave, hexagonal, rectangular and square, and some of a purely ornamental nature. These have been given a variety of finishes, ranging from mat to gloss white enamel, diffuse to specular finishes on aluminum, clear to white, thermoplastic on plastic, and white and colors on paper. These cell pattern designs have been made up in louver



Louverall and Luminous Ceiling Lighting

LARGE CELLS (8 in. x 8 in. x 8 in.) in wood louver ceiling provide harmonious decorative treatment in store.

CELL PATTERN	SHIELDING ANGLE (A) Design	(B) Min	LOUVER MATERIALS	FINISH
 SQUARE	45°	35°	Plastic	Diffuse
			Aluminum	Etched to specular
			Steel	Diffuse to gloss
 RECTANGULAR	45°	Variable	Paper	Diffuse (white & colors)
			Wood	Diffuse to gloss
 SINE WAVE	45°	55°	Plastic	Diffuse
			Aluminum	Etched to specular
 HEXAGON	45°	41°	Steel	Diffuse to gloss

sections, or panels, in a wide range of sizes and depth.

Out of much experimentation has come a considerable degree of standardization. A shielding angle of 45 degrees has been selected as satisfactory for most types of lighting installations, which means that the width of square louver cells is equal to the depth of the louver blades. It has been determined that the size of the louver cells affects light utilization very little, so the manufacturers have narrowed down the cell dimensions generally to a range of 1½ in. by 1½ in. by 1½ in. to 4 in. by 4 in. by 4 in., except for custom installations. The question of cell size is more one of architectural appropriateness than it is one of efficiency. In general the small cells, usually 2 in. by 2 in. by 2 in., and 3 in. by 3 in. by 3 in. have been found to be satisfactory for most installations except for those cases where the architect has made the louver cells large enough to form architectural elements themselves.

The problem of finish is controlled to some extent by the material used for the louver blades. Baked-on white enamel is normally used on steel, and while gloss or semi-gloss provides a slight advantage in efficiency, it has been found that a mat or semi-mat finish provides a better appearance by eliminating reflected images of the light sources and reducing average grid brightness. Anodized and brushed or satin natural aluminum finishes are used on aluminum louver blades, while paint diffuse finishes are used on wood and paper. Plastic louver blades are normally finished white thermoplastic, but other possibilities are being investigated and studied.

Most manufacturers have adopted the square, or "egg-crate," cell pattern design for standard production, and 45-degree shielding. This seems to work out satisfactorily for most installations. A few manufacturers are producing some of the more ornate cell pattern designs, and architects and designers will no doubt design and specify some custom-built louver systems which are now in the imaginative stage only. Such designs will be particularly appropriate for rooms of modern architectural and functional design.

The size of louver sections varies considerably among the different manufacturers. Basically, sections are given module dimensions to conform to standard fluorescent lamp lengths. Sizes range from 12 in. by 24 in. to 30 in. by 96 in., usually in increments of 6 inches for both dimensions. One manufacturer uses a 32-inch square section, which is a module of the eight-foot slimline lamps.

Various methods are in use for supporting louver sections from the ceiling slab overhead. Usually a T-bar framework is suspended by means of adjustable-length rods, so that louver sections rest by gravity on this framework. However, several other methods are in use, and individual manufacturers should be consulted for information relating to their own products.

The cavity cross-section, that area between the louver panels and the actual room ceiling above, is an important factor in louverall design. Studies indicate that shallow cavities will provide greater efficiency and light utilization than deep cavities. All cavity surfaces above the louver panels should be finished with a high reflectance finish, as this will improve the lighting efficiency and brightness uniformity of the louvers.

Many louverall installations have already been made using bare lamps mounted on wiring channel only. While this may appear satisfactory in white finished cavities, diffuse reflectors will improve the efficiency considerably, and semi-concentrating reflectors will further improve the efficiency. Lamps should run continuous the full length of the louver sections. Spacing between rows of lamps will depend on the illumination intensity desired, depth of cavity, louver brightness pattern, and other similar considerations. One rule which should be followed generally is to space lamps not more than one and one-half times the distance of the lamps above the top side of the louvers.

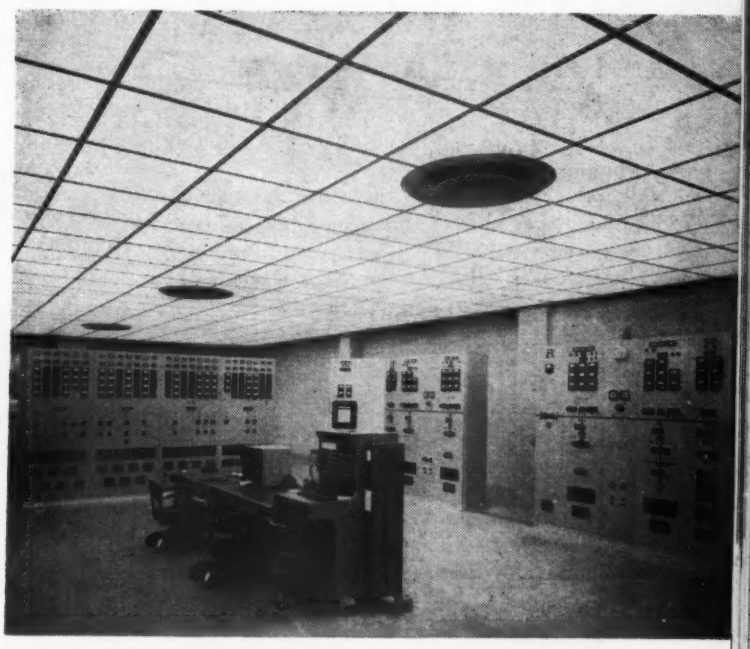
Louverall lighting has many distinct advantages. With it, the ceiling becomes a continuous plane source of light,

COEFFICIENTS OF UTILIZATION FOR LOUVERALL CEILINGS

CEILING	75%					
WALLS	50%		30%		10%	
ROOM	APPROXIMATE RANGE*					
INDEX	Low	High	Low	High	Low	High
J	.16	.28	.13	.25	.12	.23
I	.18	.31	.16	.29	.15	.27
H	.20	.34	.18	.32	.17	.30
G	.22	.37	.20	.35	.19	.33
F	.23	.40	.21	.37	.20	.35
E	.25	.43	.23	.41	.22	.38
D	.26	.45	.24	.43	.24	.40
C	.27	.46	.25	.44	.25	.42
B	.28	.48	.26	.45	.26	.43
A	.29	.48	.27	.46	.27	.44

*Taken from data published to date, and from manufacturers' literature.

EFFICIENCY and appearance of Louverall Lighting Systems are affected by louver materials and finishes.



LUMINOUS CEILING of plastic panels with cold cathode lamps above provides glareless lighting in a control room.

having low brightness which can be controlled to some extent. With louverall the lighting intensity can be increased far beyond that within the limits of comfortable indirect lighting. Ventilating ducts, sprinkler system pipes and nozzles, plumbing pipes, etc., can be concealed within the cavity above the light sources and reflectors.

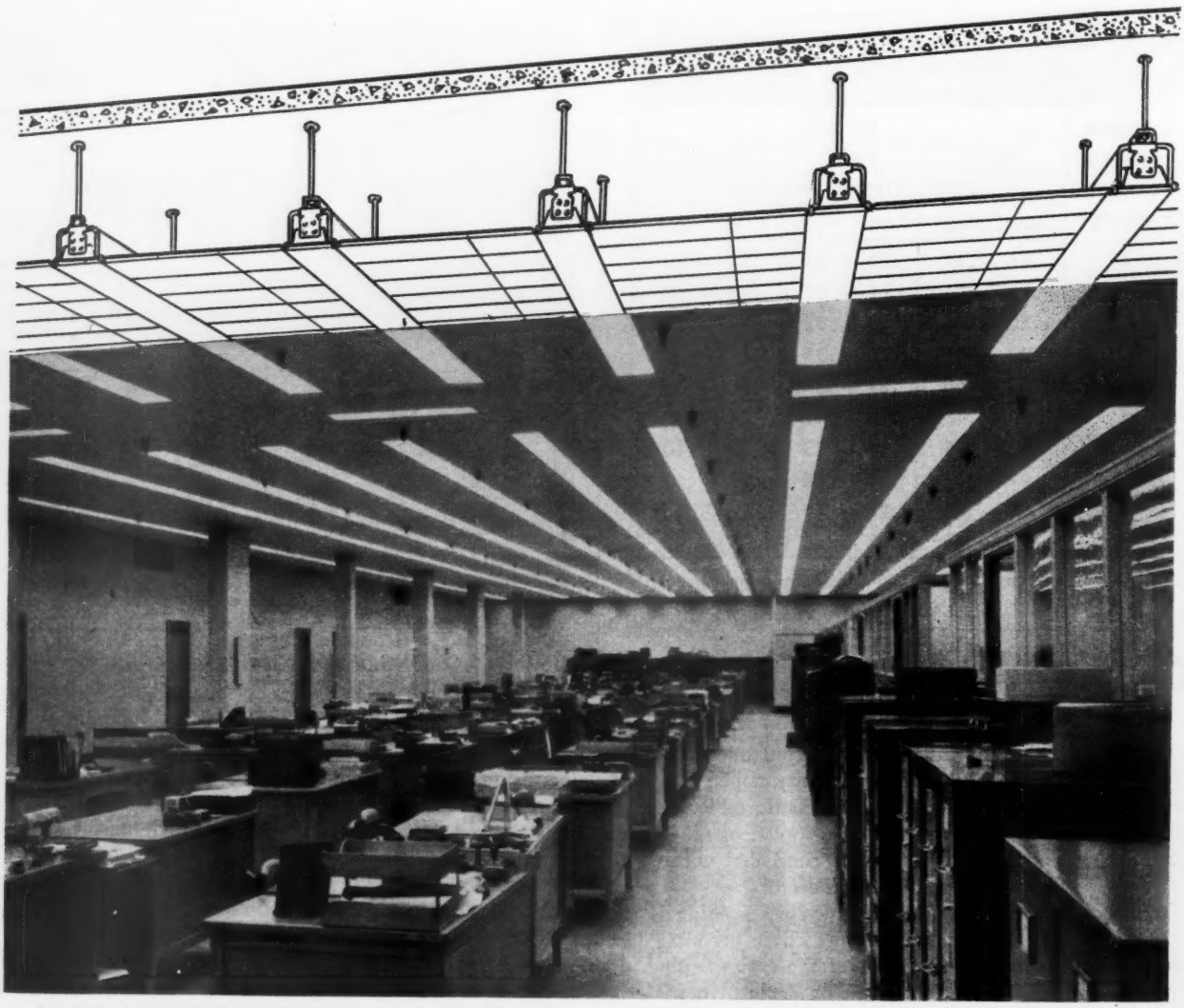
One major advantage of louverall system lighting is the wide range of lighting flexibility which it permits. The louver sections may be installed over the entire ceiling, or may be designed into a functional or decorative pattern. Louver sections may all be finished the same, or some may be one finish and others another. They may even be finished in colors for decorative purposes, either all in the same color, or some in one color and others in another color, as might be required to meet the decorative motif. Use of colored louvers distorts the spectral characteristics of the light sources very little in the resulting illumination in the room below. Illumination intensities may be increased in certain areas by installing additional light sources, such as in a store over a special display area or in a classroom where more light is required toward the inside wall to balance the daylight near the outside wall. Incandescent spotlights may also be installed either above the louver sections or in cutout sections with the bottom of the spotlight unit flush with the bottom side of the louvers. Lamps of different color quality may be combined to provide any spectral quality of resulting illumination desired. The open grid system is favorable to good maintenance.

Louverall systems have one disadvantage. This is the problem of reflected glare. Lamps are exposed to the work plane in the room below through the louver cell openings, and are in turn reflected to the eye from any gloss or semi-gloss surfaces. Studies indicate, however, that for lighting intensities of 50 footcandles or greater, this reflected glare is greatly reduced, since the brightness of the average seeing task at this intensity approximates the brightness of the light sources exposed to the surfaces in the room through the grid openings. For intensities less than 50 footcandles low brightness lamps can be used to minimize this reflected glare. Also, where the cavity is unobstructed, silvered bowl incandescent lamps or other types of equipment may be installed to provide indirect lighting in the cavity over the louvers. One complete installation of this type was made more than a year ago which has very satisfactorily solved this problem.

For a period of about ten years before the introduction of flourescent lamps, considerable interest was shown in luminous element, or "architectural" lighting. With incandescent lamps only available as a light source for use in connection with these elements, these were primarily limited to glass, in flat sheets, configurated panels, and moulded forms. Plastics were used to some extent, but the problem of excessive heat from the filament lamps considerably retarded the use of plastics for this purpose. The introduction of fluorescent lamps, in their long tubular form and comparably cool operation, served to create greater interest in the use of plastics as well as of glass, both for individual unit luminaires and for diffusing elements for decorative and "architectural" lighting. These diffusing elements are now being used to form complete ceilings or panel sections in the ceiling. They now form what is popularly called a *luminous ceiling.*

Luminous ceiling lighting is accomplished in the same manner as louverall lighting. Translucent diffusing media of glass or plastics are merely substituted for louver sections. This system of lighting has the advantage of reducing reflected glare. It has the disadvantage of requiring greater maintenance, since it collects dust and dirt rapidly which in turn reduces the lighting efficiency. Also, for intensities of 50 footcandles or more, the brightness of the luminous elements becomes excessive for comfort, since the diffusing elements themselves become the source of light for the area which they light. Light distribution from diffuse elements is inherently glaring in the normal glare zone.

Troffer Lighting



TROFFER LIGHTING SYSTEMS provide high efficiency lighting with good appearance, with all lighting equipment installed in ceiling. Light sources are shielded by baffles, louvers or diffusing materials.

COEFFICIENTS OF UTILIZATION FOR TROFFER LIGHTING		
CEILING	75%	50%
WALLS	50%	30%
ROOM INDEX	APPROXIMATE RANGE*	
	Low High	Low High
J	.28 — .40	.24 — .37
I	.34 — .48	.30 — .44
H	.37 — .52	.34 — .48
G	.39 — .55	.37 — .51
F	.42 — .58	.38 — .53
E	.44 — .60	.42 — .57
D	.47 — .65	.45 — .59
C	.49 — .66	.46 — .61
B	.50 — .67	.47 — .62
A	.51 — .68	.48 — .64

*Source: IES Lighting Handbook. Low value represents troffer equipped with diffusing glass cover. High value represents open single lamp troffer.

TROFFER lighting is the fluorescent equivalent of the old recessed incandescent lighting technique, with some refinements added. Recessed or "inbuilt" lighting, as it was commonly termed, developed into one of the popular incandescent lighting techniques about fifteen years ago, before fluorescent lamps were made available. It was only natural for lighting equipment designers to develop the fluorescent equivalent of the already popular incandescent "inbuilt" principle of lighting. The recessed metal housing units, termed "troffers" for a readily apparent reason, was the result.

Troffer lighting as a lighting system has many inherent advantages. It was among the first types of equipment to be developed for use with fluorescent lamps, and has now reached a high stage of refinement, of application and installation. Its many advantages will be easily apparent from a study of the accompanying illustrations, and include clean, unobstructed ceiling, high efficiency, flexibility of layout design, excellent shielding and brightness control, and economy in lighting equipment and wiring costs. They also include low operating cost and ease of maintenance.

A troffer lighting system consists of a series of individual

units or continuous rows of troffers recessed flush in the ceiling. These are designed to be supported by the ceiling. One troffer design is such, however, that the troffer lighting system supports the ceiling instead. Nearly all troffers are designed with an approximate twelve inch reflector opening, so that the troffer housings fit into and are supported by the standard T-bar construction used for most standard twelve-inch wide acoustical tile sections.

There are two basic types of troffers. One is the deep type troffer which provides natural crosswise shielding of approximately 45 degrees. The other is the shallow type troffer which depends on louvers, lenses or diffusing materials for variable crosswise and lengthwise shielding.

The basic elements of a troffer lighting unit consist of a reflector, wireway and ballast housing, shielding devices, lampholders, socket and starter switch for pre-heat type fluorescent lamps, and supporting brackets, angles, or suspension devices. Most troffer designs are for one or two rows of lamps, although some will accommodate more.

Reflectors are made principally of steel or aluminum, and in several shapes and finishes. Variations in shape and finish account primarily for the several troffer designs now on the market. Each shape and finish has its own lighting characteristics, and thereby its own advantages and disadvantages. Lighting application requirements vary so that requirements exist generally for each type of troffer.

Some troffers depend on either glass or plastic diffusers or lenses, in combination with proper reflector shapes and finishes, for light distribution control. These diffusers or lenses also serve for shielding the lamps in the glare zone. Diffusing lenses do little more than shield the lamps and sides of the reflectors, except to perhaps increase the diffusion. Prismatic lenses, however, serve as part of the optical assembly of reflector, lamp, and lens to accurately control the light distribution, and to effectively shield both the lamps and reflector in the glare zone. Prismatic lenses have been developed for troffers in both glass and plastic, also in both flat and molded shapes. These help provide any

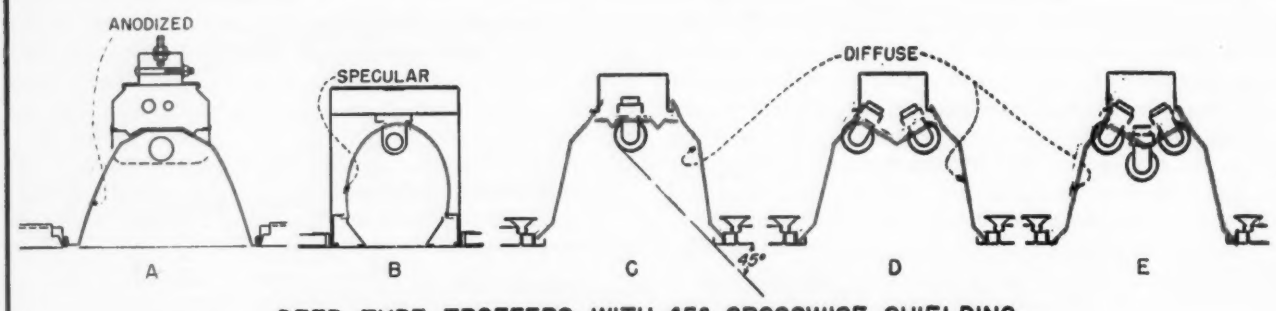
SHALLOW TROFFERS with louvers light offices of John Hancock Mutual Life Insurance Co., Boston.

SPECULAR REFLECTOR troffers using slimline lamps light one of the Chandler Shoe stores in Chicago.

SHALLOW TROFFERS with diffusing glass and four rows of cold cathode tubes light public and work areas in a bank.

TROFFERS with plastic diffusers and in geometric pattern light James F. Condon & Sons, Inc. store, Charleston, S. C.

Troffer Lighting



DEEP TYPE TROFFERS WITH 45° CROSSWISE SHIELDING

type of light distribution from diffuse to concentrating, and either symmetrical or asymmetrical.

Shielding for deep troffers is accomplished normal to the troffer by the inherent deep troffer design. Lamps are positioned high in the reflector so that they are shielded to about 45 degrees below the horizontal. Lengthwise shielding is done principally with baffles. Since the troffers are deep, the baffles may also be deep. The spacing between baffles is governed by the depth of the baffles and the degree of shielding desired. Lengthwise shielding of 30 degrees is considered good practice, since the brightness of lamps viewed along their length is less than the brightness when viewed normal to their length.

Shielding for shallow troffers is more difficult than for deep troffers. Shielding must be provided for both crosswise and lengthwise viewing, since lamps in shallow troffers are located in the normal glare zone. Shallow type metal louvers are used principally for this purpose. Since louvers tend to trap light within the troffer, considerable skill in designing these louvers is necessary. Louvers B and C, shown in the drawing on the opposite page, are only two of many designs now available.

Troffers have been designed and are available for all standard size fluorescent lamps, including the 40-watt T-12, 85-watt T-17, slimline T-8 and T-12, 40-watt T-17 low brightness, and 25 mm. cold cathode lamps.

Troffer lighting is efficient lighting. Some troffer designs are, naturally, more efficient than others. Coefficients of Utilization for a wide range of troffer types show that single lamp open and unshielded type troffers provide the highest utilization of the light output of the lamps.

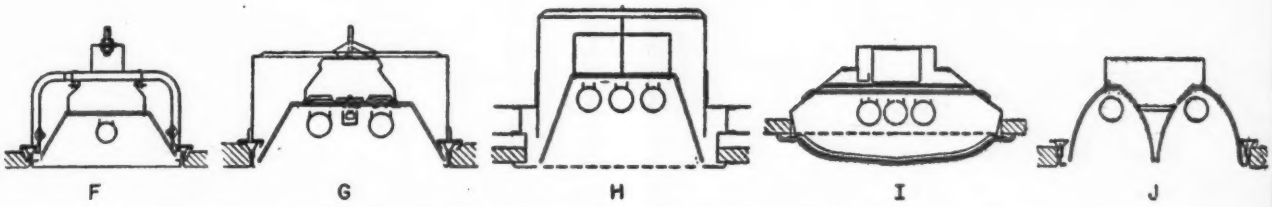
On the other hand, all troffers not equipped with diffusing or prismatic lenses have one innate disadvantage. The lamps are exposed to all room and work surfaces, the same as in a louverall lighting system. This is a disadvantage in that it increases the possibility of reflected glare. This is also true to a minor degree with troffers equipped with diffusing and prismatic lenses, except that the brightness of these lenses is considerably less than that of the lamps, and hence less of a problem.

Two methods have been used to reduce this problem of reflected glare from troffers. It has been found that for illumination of 50 or more footcandles on the work surfaces that the brightness ratio of average work surfaces to the lamp brightness is within a comfortable range. One method is therefore to design the lighting system for 50 or more footcandles—a solution within the jurisdiction of the application engineer. The other method is to use lamps with a lower surface brightness, which will accomplish the same result. This second method requires the use of a larger number of units to offset the lower lumen output of the low surface brightness lamps. The attempt to reduce reflected glare from troffers by this method, and to achieve maximum efficiency at the same time, has resulted in the design and production of the "low brightness troffer."

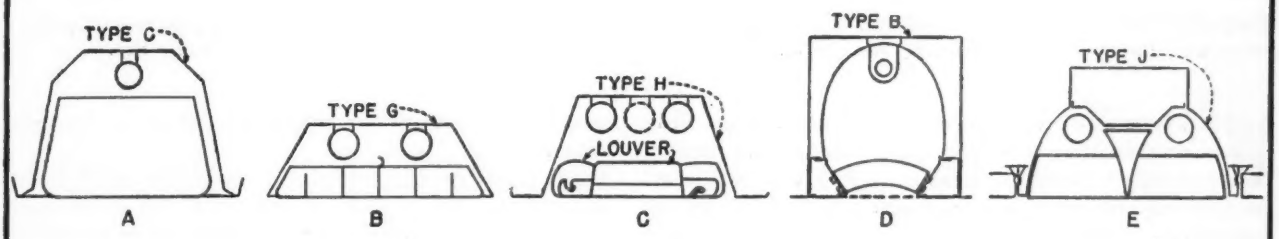
The low brightness troffer (Type A above) is a deep type troffer. The lamp is shielded csosswise from 40 to 45 degrees below the horizontal. A specular or anodized aluminum reflector of near-parabolic contour is used, which reflects nearly all the light downward below the glare zone (see drawing at bottom of next page). When viewed at right angles and within the direct glare zone, the exposed section of the reflector appears unlighted when the lamp is burning. It is usually less bright than the ceiling in which the troffer is recessed when the ceiling is lighted by reflection from the room surfaces below. Because of the low brightness of these lamps when viewed lengthwise, baffles are normally used only at the end of the reflector sections for 40-watt T-17 lamps, or on 12-inch centers for T-12 slimline lamps operated at low ma. values.

Fluorescent troffers are used principally for lighting offices, drafting rooms, conference rooms, banks, classrooms, stores and similar locations. They provide general lighting only. They can be used in continuous rows to form lines of light, or can be used in geometric patterns. Thus they are functional, conform to modern architectural design, and can be used to provide a light pattern decorative treatment suitable for most interiors.

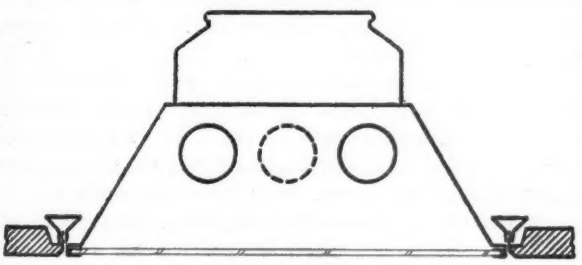
Troffer lighting provides a wide variation in illumination intensities, and hence a flexible system of lighting. Troffers can be selected with one, two, three or more rows of lamps. They can also be installed on any spacing from side-to-side to spacings of about three-fourths of their mounting height above the work plane. They can be wired for flexible switching. Through proper layout design and circuit switching, they can be used to obtain variable intensities throughout an area, as for example in a store. These many qualities, and the continuing efforts of the lighting equipment manufacturers to improve their lighting performance characteristics, have made troffer lighting systems one of the most popular in use today.



SHALLOW TYPE TROFFERS FOR LOUVER AND DIFFUSER SHIELDING

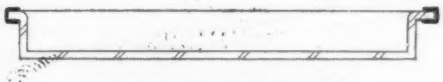


BAFFLES AND LOUVERS FOR SHIELDING



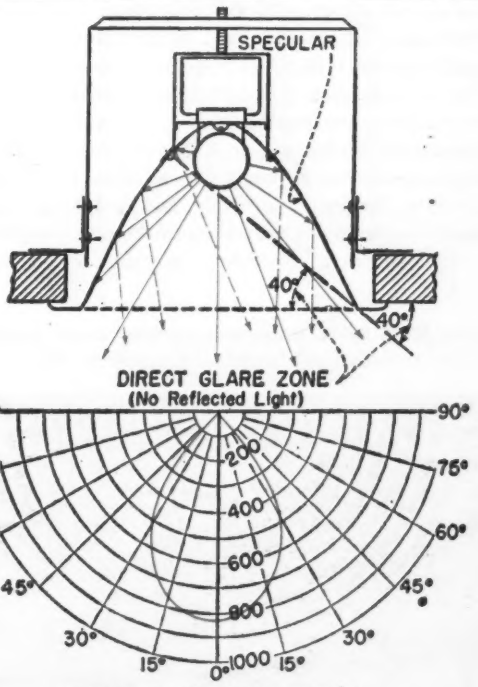
FLAT DIFFUSER
(Glass or Plastic)
A

FLAT PRISMATIC LENS
(Glass or Plastic)
B



MOLDED PRISMATIC LENS
(Glass or Plastic)
C

DIFFUSSER AND LENSES



TYPICAL LIGHT DISTRIBUTION
(Normal to Troffer)

LOW BRIGHTNESS TROFFER

Continuous Row Fluorescent Lighting

TWO CONTINUOUS ROWS of 2/40-watt louver-shielded units provide 60 footcandles in Sheboygan, Wis., bank.

CONTINUOUS ROW suspended louvered units using 2/40-watt lamps provide 50 footcandles in a Cleveland office.

WHEN fluorescent lamps were first introduced a little more than ten years ago, the first luminaire designs were based on individual units. This practice was based on tradition, following the precedent set for incandescent luminaires. This was a normal approach to fluorescent luminaire design, but not a logical one, as has since been practically demonstrated.

Incandescent lamps are small and round, and contain a point light source. Control of light from a point source automatically requires spherical treatment. Also, components used to control light from a point source, such as reflectors, refractors, and diffusers lend themselves easily to production in circular and spherical shapes. Lighting economy therefore dictates that incandescent luminaires be circular or spherical in shape, if the advantages of optical laws and mass production techniques are to be realized.

Fluorescent lamps are line sources of light. The line source, however, is as large as the diameter of the lamps. Fluorescent lamps vary from $\frac{3}{4}$-inch to $2\frac{1}{8}$ inches, and therefore less accurate optical control is possible than is true with concentrated filament incandescent lamps. This accounts for the greater diffusion inherent in fluorescent lamps.

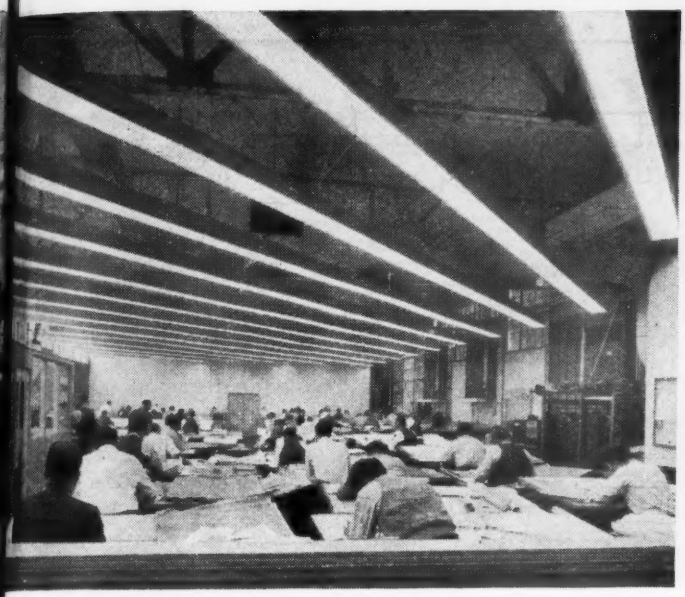
The same type of materials are used to control light from fluorescent lamps as from incandescent. But the elongated line source dictates that these materials also be of elongated or continuous line shape. Lighting economy in production of fluorescent lighting equipment is therefore possible through the mass production of lighting components in these continuous line shapes.

Fluorescent luminaires of the individual type, produced in lengths to house one or more lamps of the approximate same length as the lamps, make use of elongated reflectors, refractors, diffusers and shielding devices. Mass production economies are therefore realized.

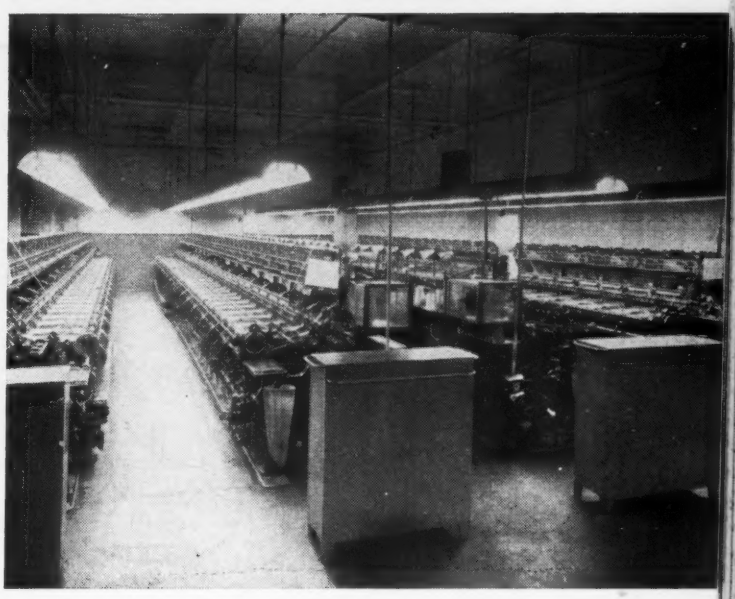
Lighting engineers, architects, and designers soon realized that fluorescent lighting offered new decorative, esthetic and functional possibilities. They also soon realized that these possibilities lay beyond the scope of the inherent design of individual units. With individual units, designers are limited to harmonious combinations of materials such as metals, glass, plastics, materials finishes, and rococo orna-

CONTINUOUS ROW suspended louvered units combined with twin spots provide light for sales in a jewelry store.

CONTINUOUS ROW luminous indirect units using 2/40-watt lamps light electric utility offices comfortably.



CONTINUOUS ROW suspended troffer units are installed diagonally in drafting room of Austin Co., Cleveland.



CONTINUOUS ROW industrial reflectors provide 75 footcandles on work in a southern textile plant.

mentation. The modern treatment of commercial and industrial interiors demands modern lighting and modern lighting equipment design, and not ornate design of individual luminaires.

What is modern lighting? And how can modern design be incorporated into fluorescent luminaires? The answers to these questions are being realized through the lighting industry's Planned Lighting program.

An entirely new approach to lighting application has evolved since the introduction of fluorescent lamps. It is reflected in the objectives of the Planned Lighting program. This approach is based on the premise that each artificial lighting problem is best solved by some one specific lighting result, and that some one specific lighting system or combination of systems will best provide that specific lighting result. Thus the lighting for each problem should be *planned*, and not be left to chance that it will be adequately solved by individual luminaires installed on symmetrical or staggered outlet spacings located by rule-of-thumb or some other out-dated practices.

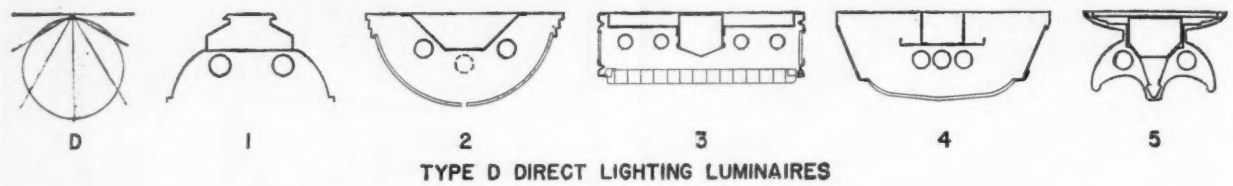
Continuous lines of light offer many advantages over the individual unit technique of lighting. They provide more uniform illumination. They are functional. For example, in stores lines of light can be used to influence customer traffic throughout the store. They provide a better appearance and conform to modern architectural design. They can be straight lines, or can be worked into curves and geometric patterns. By judicious design and placement, they can be made to provide more light where it is needed, thus providing a more economical system. They also simplify electrical wiring problems.

Except under certain conditions, as outlined under "Individual Unit Fluorescent Lighting" on page 86 the use of individual fluorescent units for general interior lighting has already become obsolete. And with the development and widespread use of louverall and luminous ceiling lighting systems, continuous row fluorescent lighting systems have become superseded in brightness ratio refinements and lighting flexibility. The equipment cost for continuous row systems is considerably less than for louverall or luminous ceiling systems, however, and for this reason may be expected to be popular for some time to come.

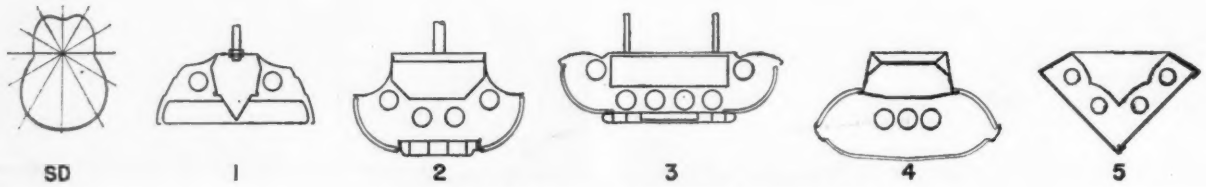
CONTINUOUS ROW suspended 2/40-watt low brightness units light class room in a Cleveland elementary school.

CONTINUOUS ROW URC-type 4/40-watt units and incandescent spots light a Beloit, Wis. store effectively.

Continuous Row Fluorescent Lighting



TYPE D DIRECT LIGHTING LUMINAIRES



TYPE SD SEMI-DIRECT LIGHTING LUMINAIRES

Fluorescent equipment manufacturers were quick to note the trend to continuous row lighting. Early luminaire designs were then modified to permit continuous row assembly. Subsequent designs have been such that basic units can be used either as individual units or in continuous row sections. These basic units are designed around the standard fluorescent lamp lengths, and primarily around the four and eight foot lengths. Some manufacturers have designed standard basic units in modules of the four or eight foot lamps so that in application, job requirements of section lengths may be more accurately met. Basic units are now also available for assembly in multiple widths of the unit, as well as in multiple lengths. Such design permits maximum lighting flexibility and provides an approach to the refinements of louverall and luminous ceiling lighting techniques with mass produced basic units.

These basic units become, in effect, a lighting component of a complete lighting system. Housings for reflector type incandescent lamps are also made to conform to the design of the basic units, and these in turn become another lighting component. With these and other lighting components from other lighting systems, the lighting engineer is now able to plan a truly *custom design* lighting installation for any interior, using available mass produced standard lighting components only.

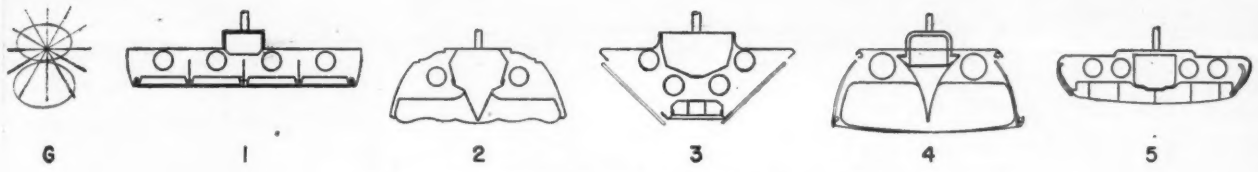
Continuous row fluorescent lighting offers the lighting engineer one of the best mediums available for complete freedom in layout and design technique. Each installation can be custom designed, using standard components or basic unit equipment. These units may be suspended, surface installed or recessed, or may be any combination of these methods of mounting. Suspended continuous row indirect lighting equipment may be combined with surface installed or recessed equipment, for example. Also, incandescent spotlights in matched design housings may be combined in the continuous row equipment where desired, especially in store lighting installations. And there are virtually endless combinations of basic units and components in geometric patterns to conform to various architectural treatments and illumination requirements.

Fluorescent luminaires in general look pretty much alike to the layman. They are either all metal, metal and glass, metal and plastic, or metal, glass and plastic. They use one or more lamps per unit, which become rows of lamps when more than one basic unit is used. These things the layman can see. Beyond that he has very little idea of the lighting characteristics of one unit versus another, or of the lighting performance of any individual luminaire.

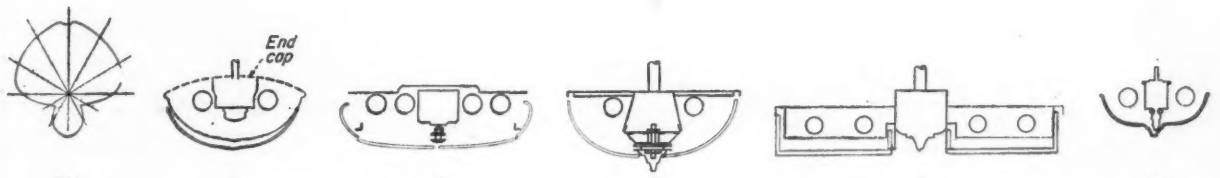
Except for actual experience in layout design and application, and the subsequent measurement of lighting performance for specific luminaires, lighting engineers too have been unable to appraise lighting characteristics and performance of the many luminaire designs now on the market merely by looking at them. Several factors enter into such an appraisal. Much of the data required has often not been available, even from the manufacturers of the units.

This lack of suitable technical data on fluorescent luminaires has been generally recognized. The problem of appraisal and selection of luminaires having certain lighting performance characteristics, which even lighting engineers who plan and specify lighting systems have experienced, has also been well known. But now something has been done about it. The Fleur-O-Lier Manufacturers have developed a lighting performance classification and rating system for fluorescent luminaires. It is called the "Fleur-O-Lier Index System". It is in effect a five-symbol code which will express and evaluate five aspects of luminaire performance. These are: 1) luminaire classification (see Table at bottom of opposite page); 2) crosswise shielding; 3) lengthwise shielding; 4) brightness in shielded zone; and 5) type of mounting.

It is now possible to express the illumination characteristics and list the performance characteristics of any fluorescent luminaire by means of the simple five-symbol Fleur-O-Lier Index System code, which lighting engineers and customers alike can interpret and easily understand.



TYPE G GENERAL DIFFUSE LIGHTING LUMINAIRES



TYPE SI SEMI-INDIRECT LIGHTING LUMINAIRES

The former uncertainty and confusion can now be dispelled. Fluorescent luminaire manufacturers now submit their luminaires to an independent testing laboratory for test and evaluation, and for assignment of a Fleur-O-Lier Index System code, or specification number.

Using the Fleur-O-Lier Index System luminaire classification, five typical luminaires under each of the five classifications were selected and are shown in cross-section in the drawings on these two pages and the following page. With each classification is also shown a typical light distribution curve for that classification. These drawings merely serve to show some of the types of luminaires that fall under each classification and the wide variety of designs which are available.

Coefficient of Utilization tables showing typical average values for each of the five luminaire classification are also given. Coefficients of Utilization should form a part of every lighting specification. Considerable importance has been given to efficiency values in the past, but these values mean little until they have been translated into Coefficients of Utilization.

The planning of lighting systems has for many years been done on more or less of a hit or miss basis. But the Planned Lighting program has given impetus to a new approach to lighting system design and application. Illuminating engineering is a necessary requisite to the design of lighting equipment and lighting application. Lighting engineers need more technical data and design information. The Fleur-O-Lier lighting performance and rating system will furnish much of this information.

FLEUR-O-LIER INDEX SYSTEM LUMINAIRE CLASSIFICATIONS*	
Symbol	Distribution of Total Lumens
D	0—10% Upward 90—100% Downward
SD	10—40% Upward 60—90% Downward
G	40—60% Upward 40—60% Downward
SI	60—90% Upward 10—40% Downward
I	90—100% Upward 0—10% Downward

*Based on the five classifications established by the Illuminating Engineering Society.

COEFFICIENTS OF UTILIZATION For Type D Luminaires*		
Ceiling	75%	50%
Walls	50%	30%
A Room**	0.60	0.42
J Room**	0.28	0.22

*Average values. See manufacturers' CU data for specific type units.
**Room Index (A—large area; J—small area)

COEFFICIENTS OF UTILIZATION For Type G Luminaires*		
Ceiling	75%	50%
Walls	50%	30%
A Room**	0.55	0.43
J Room**	0.26	0.20

*Average values. See manufacturers' CU data for specific units.
**Room Index (A—large area; J—small area)

COEFFICIENTS OF UTILIZATION For Type SD Luminaires*		
Ceiling	75%	50%
Walls	50%	30%
A Room**	0.51	0.43
J Room**	0.23	0.19

*Average values. See manufacturers' CU data for specific luminaires.
**Room Index (A—large area; J—small area)

COEFFICIENTS OF UTILIZATION For Type SI Luminaires*		
Ceiling	75%	50%
Walls	50%	30%
A Room**	0.48	0.37
J Room**	0.23	0.17

*Average values. See manufacturers' CU data for specific units.
**Room Index (A—large area; J—small area)

Individual Unit Fluorescent Lighting

INDIVIDUAL LUMINAIRES provide satisfactory lighting for some locations. Type D industrial units provide 35 footcandles in weave room of textile plant (left) but are installed on continuous wireway to permit installation of additional units if a higher intensity is desired; Type SD luminaires provide 25 footcandles in an office (center); and Type D special six-foot square units provide good lighting for Midtown offices of The Home Insurance Co., New York City (right).

GENERALLY the use of individual fluorescent luminaires to provide general lighting has already been obsoleted, as has been pointed out in the preceding four pages. There are circumstances and conditions, however, which justify their use.

In industrial plant areas where only rough work is performed, individual two 40-watt lamp reflector units provide adequate illumination for such work. In office or store relighting, where the electrical wiring is already installed and is adequate for the intensities required, individual four 40-watt or two 85-watt luminaires, or other sizes, will usually provide satisfactory minimum requirements for general illumination. Also, in relighting buildings under short term lease, such luminaires offer an economical solution.

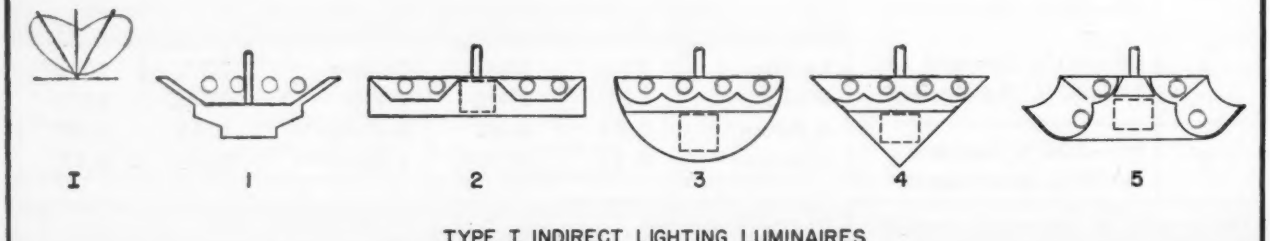
Large individual unit luminaires justify consideration in high ceiling areas. One such installation is shown in the photo above (right). In this large first-floor office the ceiling is 16 feet high. Bay areas are 18 feet square. Individual 6 ft. 6 in. square custom built luminaires were surface installed on the ceiling to light this area. Each unit contains eight 40-watt fluorescent lamps and four 150-watt R-40 incandescent lamps, concealed behind an open grid louver system.

There are many locations, such as in department stores, public areas in banks, etc., where large individual unit fluorescent luminaires will provide satisfactory lighting. Many manufacturers now design and make basic lighting units which can be connected together to form any number of designs of large lighting elements. These elements in turn become individual module units, which are applicable to the lighting of many large areas as individual units.

COEFFICIENTS OF UTILIZATION
For Type I Luminaires*

Ceiling	**75%**	**50%**
Walls	**50%**	**30%**
A Room**	**0.45**	**0.28**
J Room**	**0.16**	**0.09**

*Average values. See manufacturers' CU data for specific units.
**Room Index (A—large area; J—small area)



TYPE I INDIRECT LIGHTING LUMINAIRES

Bare Lamp Fluorescent Lighting

BARE LAMP LIGHTING is satisfactory under some conditions. Three rows of four 120 ma. slimline lamps per row light the narrow paint store (left) effectively, while four double rows of 25 mm., 120 ma. cold cathode tubing supplements recessed direct lighting in the long, narrow drug store (center). Continuous rows of 4-lamp, 25 mm., 120 ma. cold cathode tube units, eight feet on centers and at right angles to desks provide 45-50 footcandles in a drafting room (right).

THE brightness of bare "white" fluorescent lamps ranges from about 1200 to 1800 footlamberts. Under average conditions this brightness in the normal field of view is considered excessive for visual comfort.

There are certain conditions under which bare fluorescent lamps may be used, however, and still meet the requirements of good lighting practice. The apparent brightness is reduced when a bare lamp is seen against a relatively light background. Its brightness is also reduced when viewed along the axis of its length. Thus when the conditions are such that the bare lamps when installed can be viewed only against a high brightness background and along the axis of the lamps, their use may be considered.

COEFFICIENTS OF UTILIZATION
For Bare Lamp Fluorescent Luminaires*

Ceiling	**75%**	**50%**
Walls	**50%**	**30%**
A Room**	**0.64**	**0.55**
J Room**	**0.30**	**0.27**

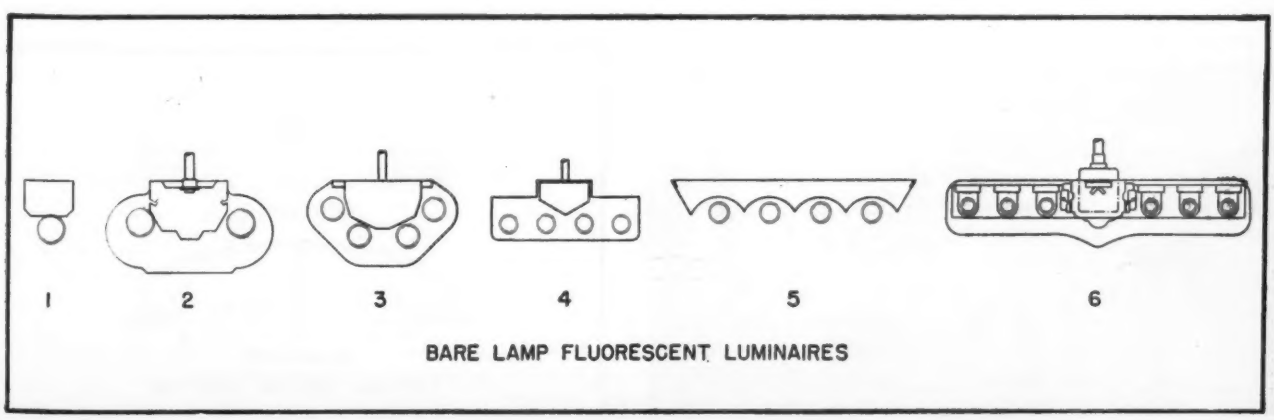
*Average values. See manufacturers' CU data for specific type units.

**Room Index (A—large area; J—small area)

Some merchandise requirements lend themselves to bare lamp lighting where a degree of brightness in the store attracts customers, and where the eyes are primarily directed to vertical surfaces. These requirements are usually found in small stores, especially those of the drug, food and variety chain store organizations.

Long narrow stores, and stores with high ceilings, often present the physical characteristics which permit the use of bare lamps with a minimum of visual discomfort. These type of stores also often contain structural elements, such as beams, which help to shield the bare lamps to some degree. Also, excessive bare lamp brightness may be reduced to a fairly comfortable range by use of low brightness lamps, such as 40-watt T-17, or slimline and cold cathode lamps operated on low ma. current.

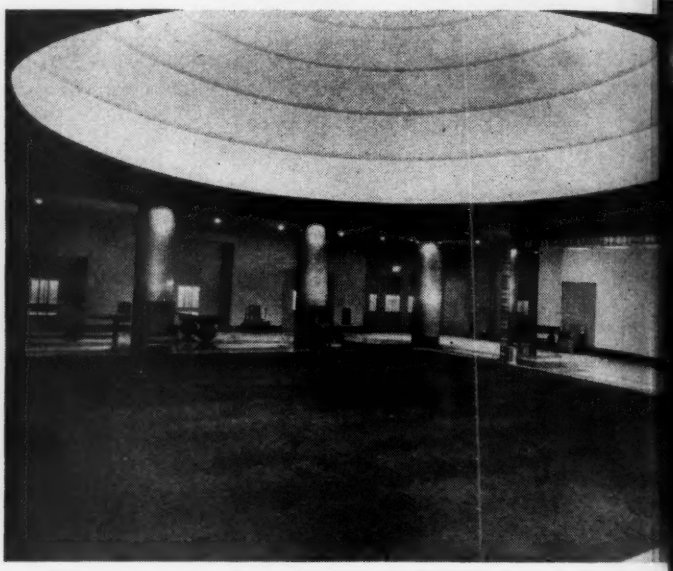
The high overall efficiency of bare lamp units is a factor in their favor, but caution should be used in all cases where they are considered, and every effort made to provide lighting free from glare discomfort.



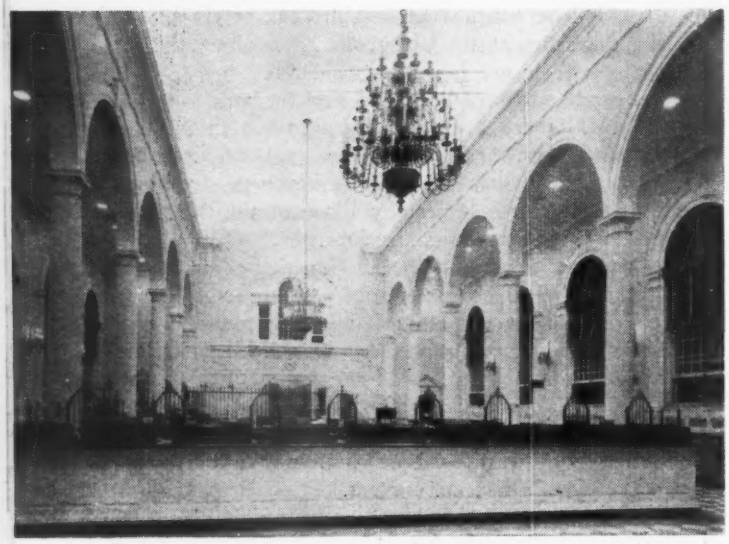
BARE LAMP FLUORESCENT LUMINAIRES

Cove and Coffer Lighting

COVE IN PUBLIC AREA of Industrial Trust Co., Elmwood Branch, Providence, R. I. contains four rows of cold cathode tubing and provides 15 footcandles.



FOUR ROWS of cold cathode tubing, in four colors, are dimmer controlled to provide spectacular lighting effects in rotunda, Hotel Statler, New York City.

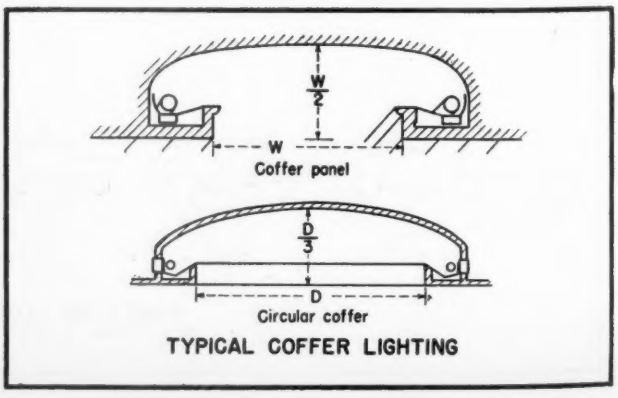


COVE LIGHTING provides general illumination in Savings Fund Society of Germantown, Pa. bank (Above). Cove with single row of 40-watt fluorescent lamps provides 22 footcandles of glare free lighting in restaurant (below).

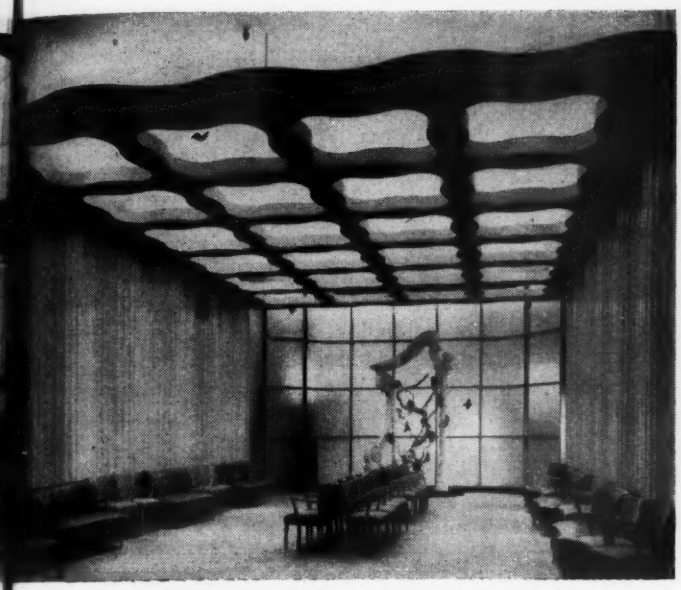
COVE lighting has been a lighting technique for about 40 years. Coffer lighting is a limited form of cove lighting, and came into prominence about twenty years ago during a trend toward so-called "architectural" lighting.

Applications of cove and coffer lighting are limited for two principal reasons. First, each is a form of indirect lighting, and lighting intensities from indirect lighting techniques are generally limited to 50 footcandles and under, due to the excessive brightness of ceilings for higher intensities. Second, cove and coffer lighting is inherently inefficient, and is therefore uneconomical where high intensites of quality illumination for work areas are essential. Cove and coffer lighting systems are therefore not considered appropriate or economical for areas where any prolonged visual work is done such as in offices, drafting rooms, classrooms, library reading rooms and other similar areas.

Indirect lighting is inherently restful in intensities up to about 50 footcandles. Properly designed, and in areas where brightness ratios are adequately controlled, it provides a soft, restful atmosphere, free from shadows and glare. The lighting result in lower intensities is most comfortable and pleasing. For these reasons, cove and



TYPICAL COFFER LIGHTING



COFFER EFFECT is created in Ansonia Shoe Store, New York City, by Morris Lapidus, Architect, by concealing fluorescent lamps above structural ceiling detail.

COFFERS ARE EQUIPPED with two rows of standard fluorescent lamps to add supplementary general lighting in a women's apparel store in Boston.

coffer lighting are used primarily in restaurants, lounges, reception rooms, waiting rooms, hotel lobbies, conference rooms, auditoriums and theatres, where eye-comfort lighting and decorative architectural treatment are wanted.

When large rooms are cove lighted, a concentrated type of light distribution is usually required to evenly light the ceiling. Point source filament lamps in specular reflectors provide this type of light distribution best. Coves should be properly designed, and reflectors properly installed in the cove so that none of the reflector equipment is visible below the maximum sight line. Care should be taken, also, to prevent any back splash of light on the wall immediately above the cove, as this will produce an annoying scallop.

Both cold cathode and standard fluorescent lamps are ideal for coves in small rooms where the beam throw is short, and where a diffuse light source is satisfactory. Custom made cold cathode tubing is best suited for most coffers, especially of circular or irregular shapes. Colored fluorescent lamps provide a most pleasing decorative effect in coffers. When two or more colors are used and lamps are controlled by dimmers, a wide variety of pleasing color effects can be obtained.

COEFFICIENTS OF UTILIZATION
For Cove Lighting*

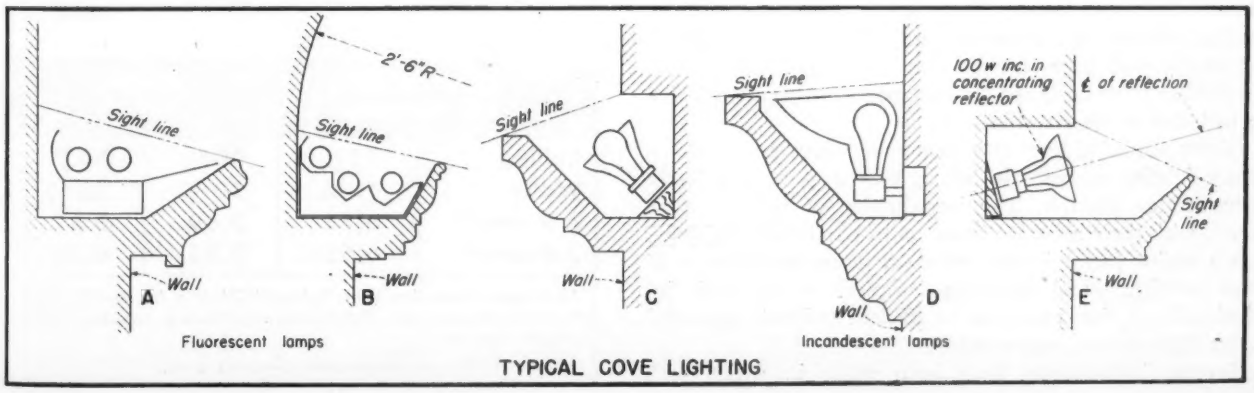
Ceiling	**75%**	**50%**
Walls	**50%**	**30%**
A Room**	**0.37**	**0.23**
J Room**	**0.10**	**0.05**

*Average values, with average conditions and good relationship of cove to ceiling. Increase values for good conditions, decrease values for poor conditions.
**Room Index (A—large area; J—small area)

COEFFICIENTS OF UTILIZATION
For Coffer Lighting*

Ceiling	**75%**	**50%**
Walls	**50%**	**30%**
A Room**	**0.22**	**0.14**
J Room**	**0.10**	**0.04**

*Average value, based on good white reflecting surface in coffer.
**Room Index (A—large area; J—small area)



TYPICAL COVE LIGHTING

Direct Downlighting

DOWNLIGHTS provide 100 footcandles on counter in jewelry store using 150-watt standard lamps and concentric louvers.

IN the classification made here, "direct downlighting" refers to those lighting systems using recessed or surface installed direct lighting incandescent units only, in which the light distribution is confined below the horizontal. This nomenclature was selected principally because the term "downlighting" has been applied popularly to all recessed individually housed units designed for the R-40 and PAR-38 reflector type lamps. The classification also includes similar units which use standard service lamps. In the drawing on the next page recessed units only have been shown, but similar units designed for surface mounting should also be included in the classification.

Direct downlighting represents an effort to create a direct lighting system with all light sources as completely concealed as possible. The introduction of reflector type lamps, with their accurate beam control and high efficiency, was a major factor in this trend. A desire on the part of some architects and decorator-designers to use dark finished ceilings, thus requiring an efficient and well-concealed direct light source, was another.

Several installations have been made in which well shielded reflector lamp downlights only have been recessed in a dark finished ceiling. A dramatic effect, such as was desired, has been achieved. This lighting technique is applicable to cocktail lounges, night clubs, restaurants and certain types of specialty stores. The effect is unusual and different. However, this technique violates many of the cardinal principles of good lighting practice, and the lighting result lacks many qualities necessary for comfortable vision.

Other installations of downlights have been made in which the ceilings have been finished in a light color, and in which these light colored ceilings have been lighted softly by cove lighting, indirect lighting from wall cases, pedestals, and other means. The lighting result in these installations has in most cases been entirely satisfactory, and the environment has been restful and pleasing. This technique of direct downlighting, supplemented by indirect illumination, creates a cheerful atmosphere and provides a lighting result well suited for many types of stores, display rooms, public building lobbies and other areas requiring sparkle and punch.

Direct downlighting predates the introduction of reflector lamps by some 15 to 20 years. The earlier units used standard incandescent lamps with auxiliary reflectors. These units, which are still available, are made in various sizes for lamps ranging from 100 to 1500 watts. Shielding is accomplished in a number of ways, and includes use of louvers, diffusing glass roundels, and round and square prismatic glass lenses. Ellipsoidal reflectors having small ceiling apertures are also used.

These standard lamp downlights are designed to provide a range of light distribution from diffuse to highly concentrating. Units with diffuse distribution are used for general lighting, while concentrating type units are used for special application lighting where high intensities are required over limited areas, as for example over jewelry counters in stores. The larger units using lamps 750 watts and larger in ellipsoidal reflectors have been used for lighting the naves of churches with high ceilings, in public areas in banks where ceilings are 25 feet or more in height, and other similar locations. The smaller units are used principally for store lighting, and for supplementing cove and coffer lighting systems where it is desirable to obtain higher levels of illumination efficiently.

An analysis of the coefficients of utilization for a number of different types of downlights shows a wide range in efficiencies. For this reason, manufacturers' data on units contemplated for use should be checked with similar data on other units which would be suitable for the same lighting problem.

COEFFICIENTS OF UTILIZATION
For Reflector Lamps Shielded*

Ceiling	75%	50%	30%
Walls	50%	30%	10%
A Room**	0.72	0.69	0.67
J Room**	0.55	0.52	0.50

*Average values. See manufacturers' CU data for specific types of shielded units, also *Illuminating Engineering*, January, 1948, pages 13 to 26.

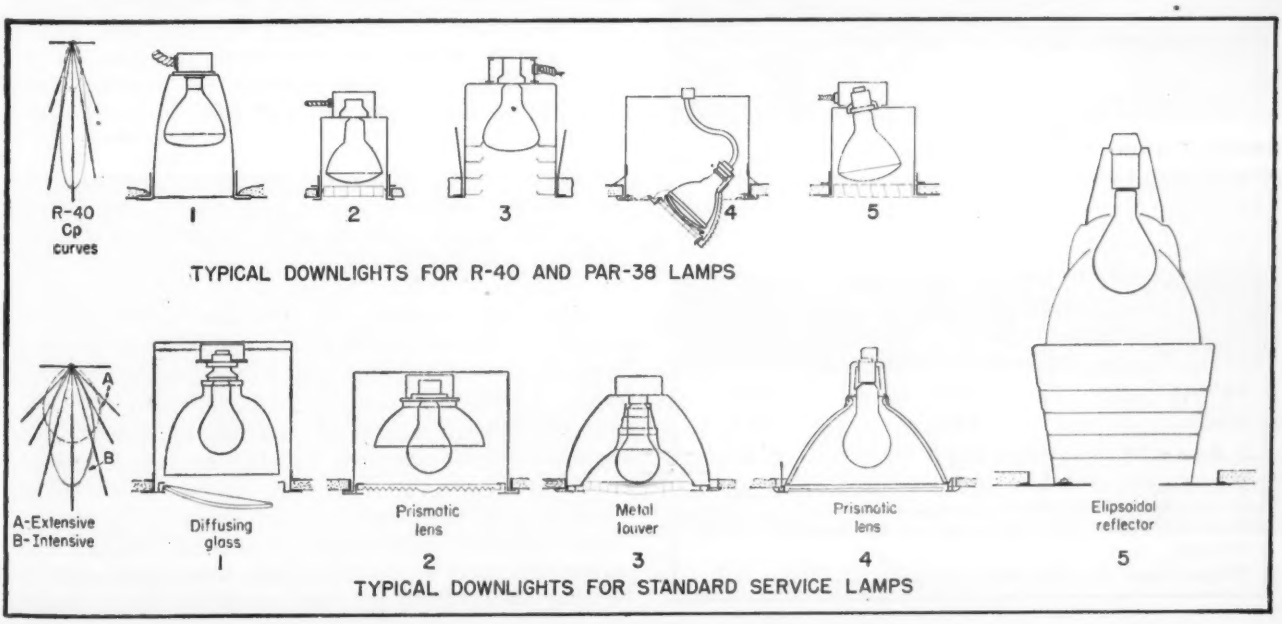
**Room Index (A—large area; J—small area)

SHIELDED DOWNLIGHTS using R-40 lamps provide efficient lighting in B. Altman & Co.'s Manhasset, N. Y. store.

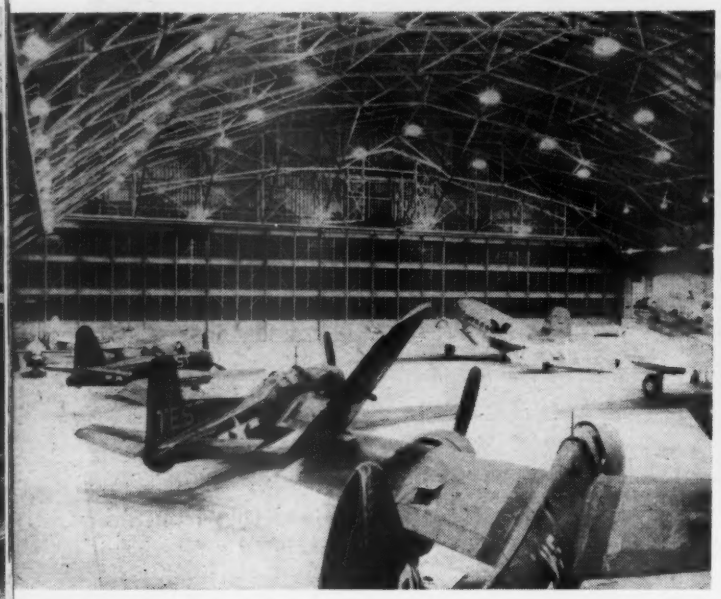
FIXED AND ADJUSTABLE type R-40 lamp units recessed in ceiling provide flexible lighting in a Philadelphia store.

ROUND PRISMATIC glass lens units with 200-watt lamps provide efficient lighting in City Bank, Washington, D. C.

SQUARE PRISMATIC glass lens units with 100-watt lamps recessed in canopy light a New York City candy store.



Incandescent and Mercury Vapor Lighting



HIGH BAY prismatic glass reflectors using incandescent lamps light airplane hangar and shop at Moffett Field, California.

NARROW BEAM reflectors provide 55 and 100 footcandles in gymnasium, The Palestra, University of Pennsylvania.

INDIRECT LIGHTING is provided in this office with bowl silvered lamps in low brightness luminous bowls.

COEFFICIENTS OF UTILIZATION
For Incandescent and Mercury Vapor Lamp Reflectors*

Ceiling	75%	50%
Walls	50%	30%
A Room**	0.69	0.65
J Room**	0.35	0.30

*Average values. See manufacturers' CU data for specific reflectors.

**Room Index (A—large area; J—small area)

INCANDESCENT and mercury vapor lighting hit its peak of popularity during the 1930's. At that time incandescent luminaires were used for nearly all commercial lighting applications, and both incandescent and mercury vapor lamps were used in industrial applications. It was the introduction of fluorescent lamps, with their inherent higher efficiency and cooler operation, that caused a swing away from incandescent lighting, and a decline in the popularity of mercury vapor lighting.

A high degree of skill and refinement was reached in the design and application of incandescent and mercury vapor lighting during this period. Accurate control of the light distribution was possible with these point source lamps, and full advantage was taken of this fact. Indirect and semi-indirect lighting from suspended type luminaires became the generally accepted practice for most commercial applications. Ingenious designers worked out many other lighting techniques to achieve the same type of lighting result. These included the use of reflectors in wall urns, floor pedestals, on top of floor and wall cases in stores, and in various other ways.

There are many commercial and industrial general interior lighting problems where incandescent and mercury vapor lighting are applicable and economical. In industrial high bay areas, the usual solution is the installation of 1000- or 1500-watt incandescent lamps in concentrating or semi-concentrating type reflectors, or a combination of incandescent and 400-watt or 3000-watt mercury vapor lamps. In some large industrial areas with ceilings 30 feet or more in height, the 3000-watt mercury vapor units only are used.

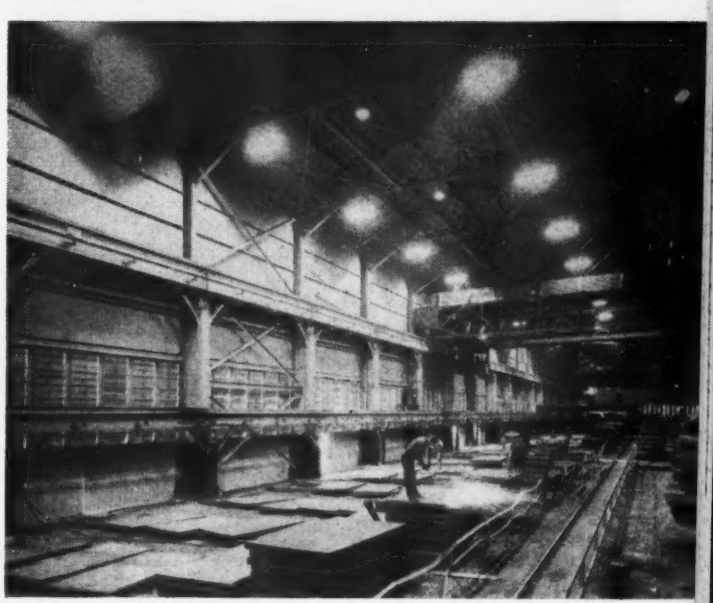
Period design and decorative individual unit incandescent luminaires are appropriate for lighting many interiors, including restaurants, waiting rooms, hotel lobbies, churches, post office lobbies, court rooms, public areas in banks, and other similar areas. Commercial designs are also appropriate, and in some instances more economical, for lighting offices, drafting rooms, stores, corridors, hospitals

MERCURY VAPOR and incandescent reflector units are staggered to obtain good color quality in this industrial plant.

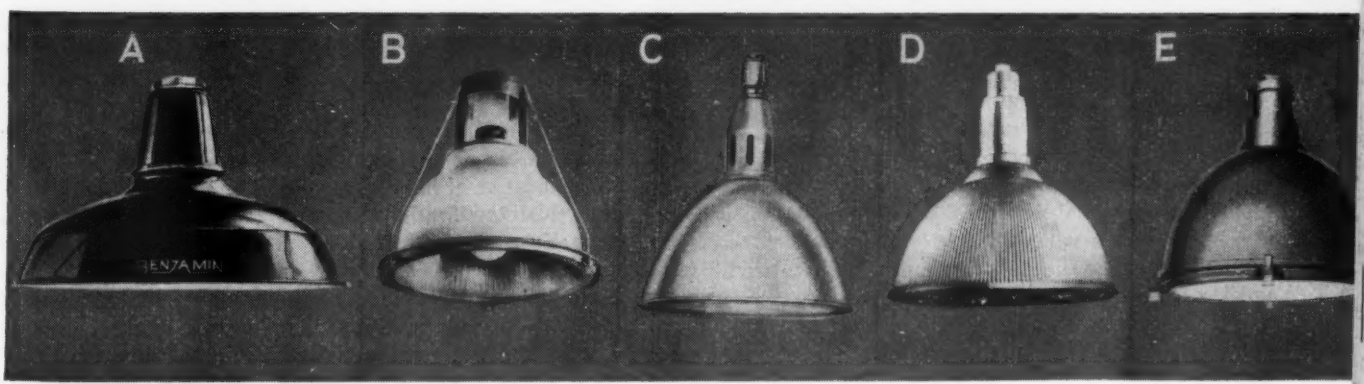
TWIN REFLECTORS, 1,000-watt inc. lamp in one, 400-watt mercury vapor lamp in other, provides 45 fc. in stove plant.

and school classrooms. For example, a great number of schools use six 750-watt silvered bowl suspended luminaires to light an average size classroom. These provide an intensity of approximately 30 foot-candles maintained. Where power rates are low, this method of lighting proves to be more economical than fluorescent lighting because of the low first cost of the luminaires, the low cost of electrical energy, and the small number of hours the light are used annually.

Mercury vapor lamps produce an average of 30 lumens per watt, or about 50 percent more than incandescent lamps. They require energy-consuming auxiliaries for their operation, however, and a time interval of from five to seven minutes to reach full brilliancy after being turned on. The color quality of these lamps is predominantly monochromatic, or blue-green. For these reasons it is desirable to supplement mercury vapor lighting systems with incandescent lighting. The usual practice is to use twin reflector units, one for a mercury vapor lamp, the other for an incandescent lamp; or use a staggered layout system with incandescent lamps in every other outlet.



PORCELAIN REFLECTORS with five-foot long 3-kw. mercury lamps provide 50 fc. in slab inspection area of steel mill.



TYPICAL INDUSTRIAL REFLECTORS for incandescent and mercury vapor lamps. A—Porcelain enameled steel. B—Prismatic glass. C—Alzak aluminum. D—Silver mirrored glass. E—Steel with inner reflector and dust-tight cover.

Special Application Lighting

TYPICAL SPECIAL APPLICATION LIGHTING. Upper left—Continuous trough with fluorescent and incandescent lamps light wash basins. Upper right—Fluorescent brackets light bank teller's window and counter. Lower left—Inspection light consisting of industrial reflector and black louverplas. Lower right—Dust-tight 3/40-watt industrial reflectors light bus inspection pits.

SPECIAL application lighting covers a wide field. It covers all those special local lighting problems where general diffuse overhead lighting over an entire work area is not adequate. In the lighting system classification used here, it also covers all commercial and industrial interior lighting which cannot be classified under any of the other types of lighting systems.

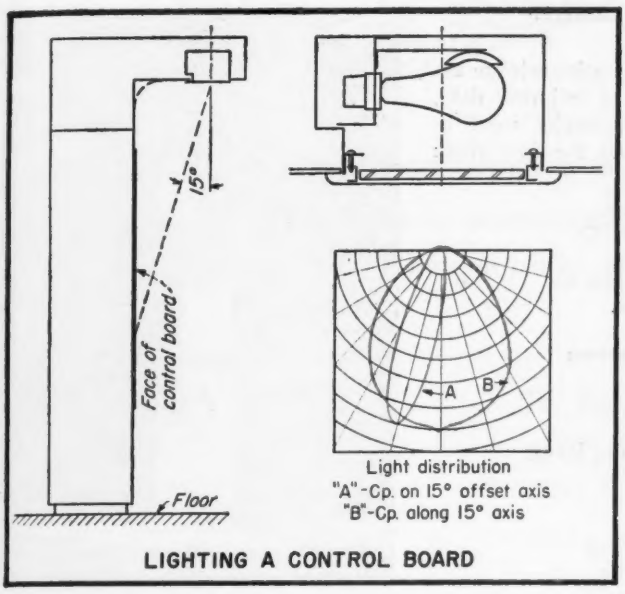
Nearly all lighting equipment manufacturers make one or more special application lighting units. These units cover applications ranging from major surgery hospital operating lights to exit lights, or from special inspection lights to night lights.

In the commercial lighting field a list of special application lighting units would include library stack lights, library table reading lamps, bank check desk lights, tellers' cage units, business machines local lighting units, picture lighting brackets and units, x-ray film viewing units, major and minor surgery operating room lighting units, dental office lighting units, private and ward room hospital lighting units for reading in bed, and other similar applications. The list would also include special display lighting units for stores, show window, floor case and wall case lights, counter color matching units, spotlights, and other similar lighting equipment used throughout today's modern store.

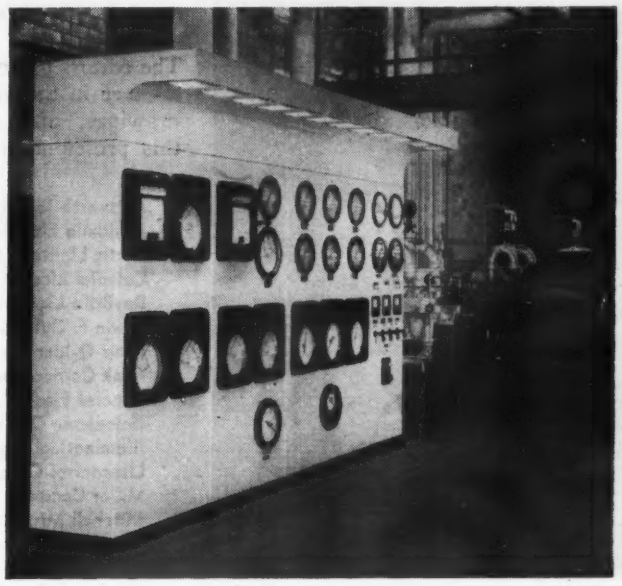
In the industrial lighting field a list of special application lighting units would include inspection lights, stock bin units, color matching units, local machine lighting units of the fixed and adjustable types, intensive beam units, vapor-proof and dust-tight units, explosion-proof units, and many others.

Shown on this and the following two pages are a number of examples of typical special application lighting, which are indicative of the many types of lighting units which fall into this classification. In some cases, a standard lighting unit with some special quality of light distribution or other special characteristic may be employed to solve a particular local lighting problem, in which case it would also be classified as a special application lighting unit when so used.

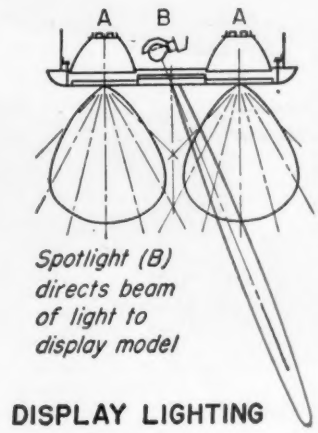
Lighting engineers and lighting salesmen can simplify their job of planning and selling lighting by collecting and classifying as wide a selection of types of lighting units and their application as possible. Such classification is applicable



PRISMATIC GLASS LENSES provide asymmetric light distribution to evenly light a control board.



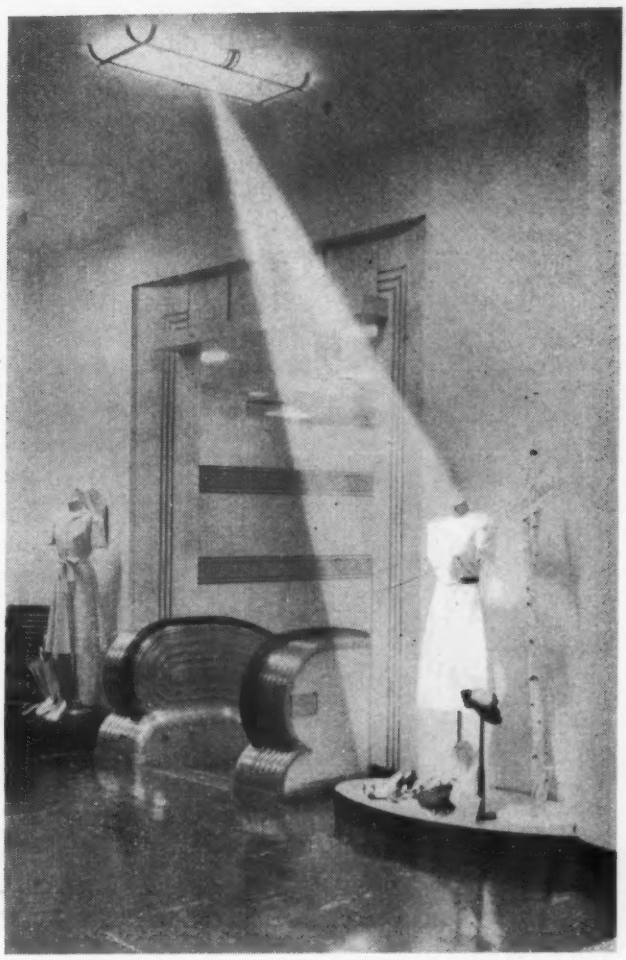
LIGHT FINISH on control board improves brightness contrast relations. (Lighting details at left).



to installation photograph binders, lighting equipment catalogs, and engineering or technical data sheets.

Lighting engineers recognize that almost every lighting problem can be solved in more ways than one, and that more than one type of lighting unit may be used for the solution. They also know that some one unit will do the job best. It therefore becomes a problem of selecting the one unit which will do the job most satisfactorily. To do this, lighting engineers must keep fully informed on all available types of equipment. They must have distribution curves to show specific light distribution patterns of units, and data on efficiencies.

Special application lighting lends itself well to the *planned lighting* concept. The planned lighting layout which reflects an analysis of each lighting problem in the area to be lighted, and includes a well-thought-out solution to each lighting problem, will be found easy to sell. It will be the layout that will provide the greatest satisfaction and economy to the lighting customer. It will build good will, and a confidence and respect for the lighting engineer who planned it.



BEAM OF LIGHT from ceiling luminaire accents display model at right, demonstrating contrast with model at left lighted only by general illumination.

Special Application Lighting

ADJUSTABLE operating room light with luminous canopy provides 1000-3000 footcandles.

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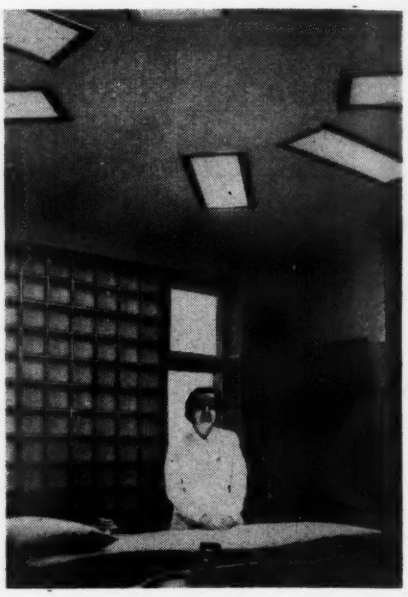
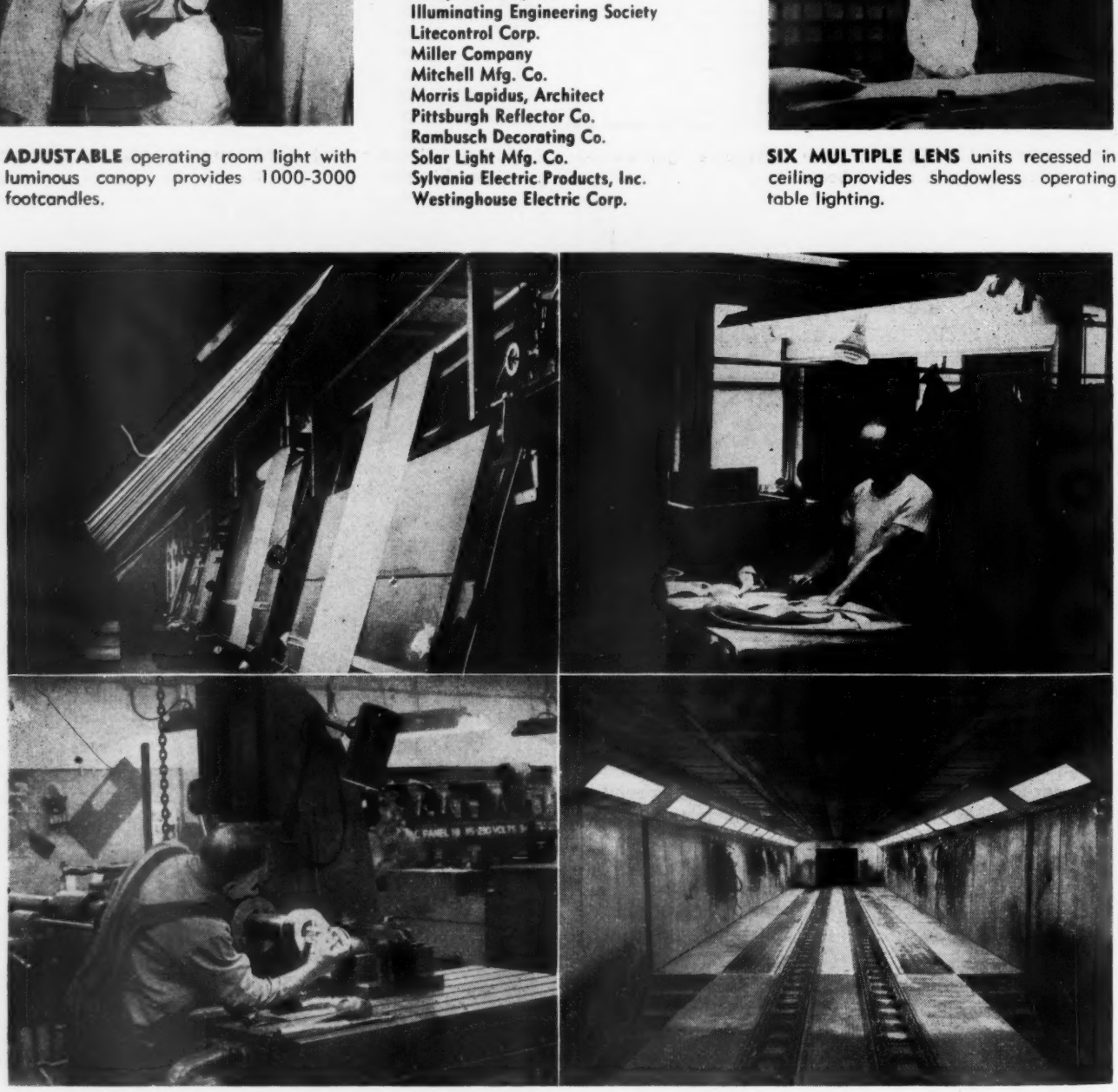
Illuminating Engineering Society
Litecontrol Corp.
Miller Company
Mitchell Mfg. Co.
Morris Lapidus, Architect
Pittsburgh Reflector Co.
Rambusch Decorating Co.
Solar Light Mfg. Co.
Sylvania Electric Products, Inc.
Westinghouse Electric Corp.



SIX MULTIPLE LENS units recessed in ceiling provides shadowless operating table lighting.



TEN DAYLIGHT fluorescent lamps in special perch light units provide 300 footcandles for cloth inspection (upper left). Louvered R-40 lamp and 2/85-watt industrial reflector provides good light for inspection at steam table (upper right). R-40 lamp in adjustable housing lights local area to high intensity (lower left). Vaportight fluorescent units installed on angle, lights an auto paint spray room effectively (lower right).

Cost of Apprentice Training

How much of an investment does a contractor have in a fully trained electrical apprentice and when will this investment begin to pay off? This searching analysis of the problem gives the answers.

By Ray Ashley

Research Engineer
Electrical Contractors
Association of City of Chicago

THE electrical contracting industry is constantly confronted with a challenge to supply mechanics vested with knowledge and skills equal to the demands of modern electrical construction. These demands become more exacting from year to year, and it requires much effort and astute planning on the part of electrical contractors to keep abreast of the times. To meet such demands, one of the first steps is the careful selection and proper training of men.

Carefully planned apprentice training has long been recognized as an indispensable institution in the electrical contracting industry. Since much has already been written on the subject by Walter Collins, Ed Herzberg, and other deans of apprentice training, many phases of the subject will be omitted here.

Three sweeping questions will in a general way set forth the problems to be considered in this article:

1. What does it cost to train apprentices?
2. Who bears the burden?
3. Who benefits?

An analytical study of the accompanying chart "Estimated Cost of Apprentice Training-Electrical" will enable us to bring out many points which will later assist in answering the above questions. Before the reader can appreciate the figures used, however, he must understand what the term "Apprentice Training" is intended to embrace.

Scope of Training

As it will be used here, the term "Apprentice Training" means *proper training in all branches of electrical construction normally encountered by electrical contractors.* A present-day graduate of an apprentice training course, properly administered, has a better than average education and is a skilled mechanic. He has a good knowledge of elementary electricity, some knowledge of advanced electrical problems, is familiar with building construction practices, and is skilled in making electrical installations.

The figures used in the columns of the accompanying chart are based on the training being properly carried to completion in the four-year training period. This training must be paid for, regardless of when the mechanic gets it. If it is not given during the regular training period, it will have to be paid for at a higher rate at some later time.

Apprentice training continues for four years. To provide for gradual increases in salary, each year is divided into four 13-week periods. There are 16, in all, of these 13-week periods, and the training cost is figured for each.

The term *"Estimated"* is used in the heading of the chart. Such costs, as those for training mechanics, have to be estimated as they involve items for which exact costs cannot be established. There is no means of accurately measuring the productivity of an individual working in a gang on varied forms of construction. Neither is it practicable to try to keep exact record of the time used by the regular mechanics in training new men. The cost to the job of having one of the crew periodically drop out a day for school, is also a debatable amount. The more advanced the apprentice gets, the more costly this interruption of work becomes.

Division of Costs

For the purpose of study, three divisions of cost "estimated" were made, namely:

1. Value of services (Cols. 8-9).
2. Expense of training (Field costs —Cols. 14-15).
3. Carrying costs (Col. 16).

These divisions are designed to cover the whole of training expense. The sum of the three costs is shown in Columns 17 and 18. *The chart (Col. 18) shows that for the first three years the contractor's expenses exceed the dollar value of the services.* Column 17 indicates that for each period of the last year, the contractor gains.

Value of Services

The index of the dollar value of an apprentice is the pay of a first class journeyman electrician, which as used here is $80.00 per week. By estimating the productive labor as a percentage of that of a journeyman, the dollar value to the contractor is figured. Today, hourly rates may be higher, but the percentages and ratios used below still apply.

For the first period of training the productive labor is estimated to be 20 percent (See Col. 5) of that of a journeyman electrician. The value of the services per week is 20 percent of $80.00 or $16.00. (See Col. 6). For the 13-week period, the amount as shown in Col. 7 is $208.00. Column 4 shows that the contractor paid $247.00, or a premium of (247-208) $39.00.

Following the same sequence of fig-

ASHLEY ON ESTIMATING

Among electrical construction people in every town, state or English-speaking country where this magazine penetrates, Ray Ashley's name is a by-word in estimating and job analysis. His authoritative articles backed by a lifetime of practical industry experience have been a compelling force in the development of modern electrical estimating methods and practices.

Few days go by that we do not receive requests for a practical source book on electrical estimating. We can now announce that a book which answers these inquiries and which we can strongly endorse is rolling off the presses. It is "Electrical Estimating" by Ray Ashley, $6.50, published by McGraw-Hill Book Co.

ESTIMATED COST OF APPRENTICE TRAINING-ELECTRICAL

YEAR	THREE MONTHS PERIOD (13 WKS.)	RATE OF PAY PER HOUR $	RATE OF PAY PER WEEK (AV. 36 HRS. PLUS $1.00 FOR 4 HRS. SCHOOL)	SALARY FOR PERIOD (13 WKS.) A	VALUE OF SERVICES % OF JOURNEYMAN SEE NOTE 1.	VALUE OF SERVICES PER WEEK $	VALUE OF SERVICES FOR PERIOD (13 WKS.) B	NET VALUE OF SERVICES B—A GAIN +C	NET VALUE OF SERVICES B—A LOSS -C	EXPENSE OF TRAINING MECHANICS TIME % OF WEEK	EXPENSE OF TRAINING MECHANICS TIME COST PER WEEK	EXPENSE OF TRAINING MECHANICS TIME COST 13 WEEKS D	EXPENSE OF TRAINING PRACTICE MATRL. & TOOLS E	FIELD COSTS CONTR'S. BALANCE C,D,&E COMBINED +F	FIELD COSTS CONTR'S. BALANCE C,D,&E COMBINED -F	CARRYING COSTS IN EXCESS OF NORMAL SEE NOTE 2. G	TOTAL COST CONTR'S. BALANCE F&G COMBINED +H	TOTAL COST CONTR'S. BALANCE F&G COMBINED -H	FILL IN YOUR OWN ESTIMATED COSTS BASED ON LOCAL WAGE RATES. F	G	H
COLS.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18			
					INDUSTRIAL, COMMERCIAL, & RESIDENTIAL WORK																	
1	1ST	0.50	19	247.	20	16.	208.	—	39.	4	3.20	42.	—	—	81.	87.	—	168.			
	2ND	0.80	29.80	387.	25	20.	260.	—	127.	4	3.20	42.	5.	—	174.	83	—	257.			
	3RD	0.90	33.40	434.	30	24.	312.	—	122	4	3.20	42.	10.	—	174.	78	—	252.			
	4TH	0.90	33.40	434.	30	24.	312.	—	122.	4	3.20	42.	10.	—	174.	78.	—	252.			
2	5TH	1.00	37.	481.	35	28.	364.	—	117.	5	4.	52.	15.	—	184.	74.	—	258.			
	6TH	1.00	37.	481.	40	32.	416.	—	65.	5	4.	52.	15.	—	132.	69.	—	201.			
	7TH	1.15	42.40	551.	45	36.	468.	—	83.	6	4.80	62.	15	—	160.	65.	—	225.			
	8TH	1.15	42.40	551.	50	40.	520.	—	31.	6	4.80	62.	15.	—	108.	60	—	168.			
3	9TH	1.30	47.80	621.	55	44.	572.	—	49.	6	4.80	62.	10.	—	121.	54.	—	175.			
	10TH	1.30	47.80	621.	60	48.	624.	3.	—	6	4.80	62.	10.	—	69.	49.	—	118.			
	11TH	1.45	53.20	692.	65	52.	676.	—	16.	5	4.	52.	5.	—	73.	42.	—	115.			
	12TH	1.45	53.20	692.	70	56.	728.	36.	—	5	4.	52.	5.	—	21.	37.	—	58.			
4	13TH	1.60	58.60	762.	80	64.	832.	70.	—	2	1.60	21.	—	49.	—	23.	26.	—			
	14TH	1.60	58.60	762.	85	68.	884.	122.	—	2	1.60	21.	—	101.	—	18.	83.	—			
	15TH	1.75	64.	832.	90	72.	936.	104.	—	2	1.60	21.	—	83.	—	13.	70.	—			
	16TH	1.75	64	832.	95	76	988.	156.	—	—	—	—	—	156.	—	5.	151.	—			
TOTALS				9380.			9100.	491.	771.			687.	115.	387.	1471.	835.	330.	2247.			
LOSSES DUE TO APPRENTICES DROPPING OUT (APPROX. 5% IN THE FIRST TWO YEARS)																		89.			
																	330	2336.			

NET COST OF TRAINING $2006. (2336.-330.) SEE COL. 17 (+H) & COL. 18 (-H)

NOTES:-

1. — $80. PER WEEK WAS USED FOR JOURNEYMAN RATE (40 HRS.)
2. — CARRYING COSTS, NOT INCL. IN TABLES, ARE EQUAL TO APPROX. 10% OF (JOURNEYMAN PAY PLUS TRAINING EXP.-LESS VALUE OF SERVICES)
   EXAMPLE-EST. FOR FIRST PERIOD = 10% OF [(1040+D+E)−B] = 0.10[(1040+42+0)−208.] = 87.40 (87. USED)
3. — COSTS BASED APPRENTICE BEING WELL TRAINED IN ALL BRANCHES OF WORK DESIGNATED BY HEADING.

8-18-47. REV. 7-28-48
ELECTRICAL CONTRACTORS ASS'N. OF CITY OF CHICAGO
E.A. 2-28-49

ures for the 13th period (1st quarter 4th year), we find that the contractor gains $70.00 (Col. 8). In the four-year period the total salary paid is $9,380.00, while the value of the services is only $9,100.00. The contractor has invested $280.00 to cover this part of his expense of training.

Productive Efficiency

The percentage of productivity of apprentices is a much debated question. The diversity of opinions is largely due to lack of study of basic facts.

Column 5 shows a graduated scale starting at 20 percent for the first period, and increasing to 95 percent for the final quarter of the fourth year. We know this does not depict actual conditions, but for estimating purposes it is the logical method to follow. It would be impossible to show actual percentages. An apprentice may follow a special line of work for a period and his productivity rises to 50 percent; then, upon being transferred to a new branch of work, it drops back to almost zero. His average for the two types of work would be 25 percent. *It is his average ability to perform all lines of work, that is represented by Column 5.*

For actual installation work, most beginners are, for a time, a hindrance rather than a help. They can, however, aid in handling materials and tools, run errands, keep the storeroom in shape, and do other odd jobs. This useful work enables us to allow 20 percent for the first period.

One may learn how to perform a piece of work in a comparatively short time, but it may take weeks on the same type of labor before he attains any great degree of efficiency. House wiring is generally regarded as a simple line of electrical construction, yet any mechanic, trained or untrained, who is new to the work, requires months before he can keep pace with a veteran residential wireman.

Weighing the complexity and number of all the new operations which the apprentice must study, practice, and master before he is a full fledged electrician, one realizes that to complete the work in four years, he will have to be a bright and diligent workman. The progress must be rapid if the schedule of productivity shown in Column 5 is maintained.

At the close of the war many young men were available whose education, training, and experience enabled them to both produce more and learn faster than the young apprentice starting from scratch. This was fortunate for the contractors as well as their customers, as such apprentices can complete the regular four-year training in three years.

In order for apprentices to keep up with the percentage ratings shown in Column 5, they require attention from well trained mechanics. This supervision must be paid for by the contractor.

Expense of Training

Referring again to the chart, under the heading "Expense of Training", we find the two following items:

1. Mechanics' time (Cols. 10-12).
2. Practice materials and tools (Col. 16). Each of these will be covered in its turn.

From the most menial task to the highly specialized services, every new piece of work undertaken by the apprentice requires attention from a trained workman. System, and sometimes skill, are required for unloading and handling material as well as for installing it. The beginner must be taught this.

There are days when the apprentice will go along with little attention, whereas other days much of the mechanic's time will be consumed explaining and demonstrating new operations. Often the instructor is obliged to stand by while the beginner tries his hand at the work. More costly than either (or both) instruction or lost time, may be the reduction of the mechanic's own productivity due to working with an apprentice instead of another trained mechanic.

An aveage of 4 % of the mechanic's time is charged to training over the four years. Suppose 2% were charged to reduction of the mechanic's productivity; that would leave 2% for training and instruction time. For an eight hour day, 2% would be 9.6 minutes. There are times when it takes almost that long for the mechanic to figure out how to use the apprentice to the best advantage.

In addition to electrical work, there are all of the other trades to be studied. The beginner must be taught how to read the plans of all other trades as well as the construction procedure and methods of such trades. He receives preliminary instructions in his school work, but such instructions must be augmented by on-the-job tutoring.

Practice Materials And Tools

The total amount charged to practice materials and tools is $115.00. (Col. 13). *This represents the amount in excess of normal costs for spoilage and use of tools.* The beginner must have materials to practice on and is bound to spoil some. Tools used by a novice are tied up longer than normal, and subject to damage.

Since the total amount charged to tools and practice material is only $115.00, or a little over 50 cents (average) per week, it seems unnecessary to go into extended details on the subject.

Excess Carrying Costs

The cost of carrying an employee on the books is approximately the same regardless of rating. Normally, it costs in the neighborhood of 20% of the payroll to carry journeymen. To be very conservative, only half this amount, or 10% of journeymen's pay, was used as the carrying cost of an apprentice. Explanation of the method of determining excess carrying costs follows.

At $80.00 per week, the total journeyman pay for a 13-week period would be $1,040.00. Using the above percentage (10%), the normal cost of carrying the apprentice would be 10% of $1,040.00. The excess cost would be 10% of ($1,040.00 *less the value of services*). This is shown in Column 7 of the chart.

In addition, the contractor has a carrying cost on the "Expense of Training" item. Ten percent of this amount is also used. The total excess cost (not included elsewhere) for the second period of taining, is figured as follows:

0.10 x ($1040.—$260.)	= $78.00
0.10 x (42+5)	= 4.70
(See Cols. 12 and 13)	
Total excess carrying cost	= $82.70
($83. used)	

Total Costs

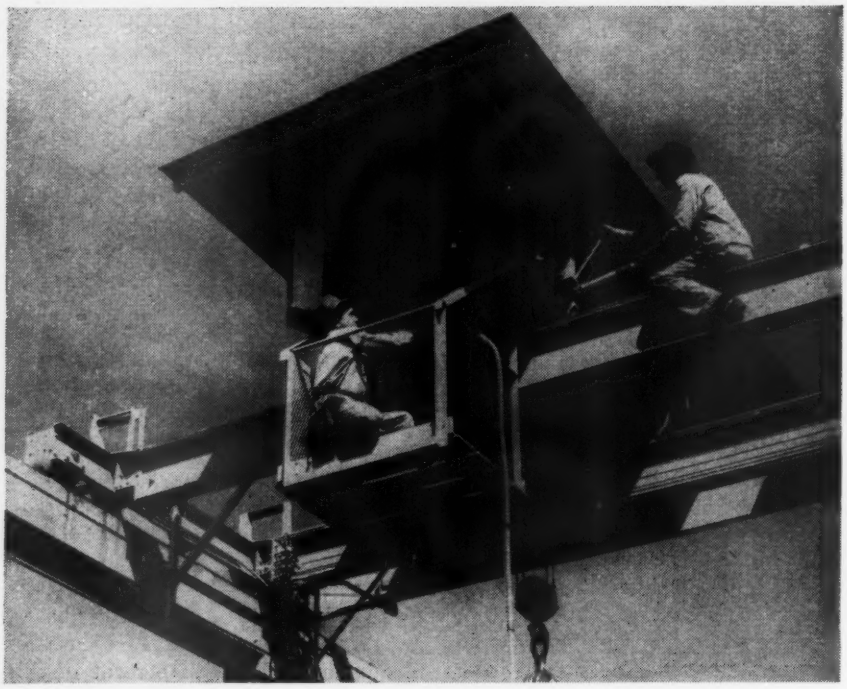
The costs for each 13-week period are shown in Columns 17 and 18. Col. 17 shows the figures for the periods which netted a gain for the contractor, and Column 18 shows the periods requiring an investment by the contractor.

The gain for the fourth year (Col. 17) is $330.00, and the total expenditure for the first three years, including losses due to apprentices dropping out, is $2,336.00 (Col 18). The net investment by the contractor is therefore $2,336 — $330 or $2,006.00.

A net return of 10% on a $200,000 (cost) job would be required to pay the cost of training one apprentice. That is part of the cost of doing business, however, and must be accepted along with other costs.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

Practical Methods



Safety features installed on a yard crane include a protective roof and a rail enclosed platform for maintenance electricians which is accessible from a warehouse roof.

Yard Crane Features Safety

SAFETY

Because of its isolated position in the plant, and because several departments used it, the yard crane shown in the photograph was quite a maintenance headache. This was caused primarily by the fact that none of the departments using it were made responsible for its proper functioning, and because of the difficulty of getting at its controls.

One serious difficulty was the fouling of the hoist lines with either the main trolley wire feeders or the auxiliaries. This cross-over resulted in ruined hoist cables from the arcing, as well as gouged and burned spots on the wires. Since some lifts other than the vertical had to be considered, the engineering department planned several guards plus a stage for the safe access to the control panel.

Four channel iron uprights were bolted on the frame to support horizontal members on which a metal roof was welded in place. This roof fends off the long winter rains and the vicious summer sun that played havoc with the insulation. This was followed by the fabrication of the angle iron fenders for the two sets of trolley wires which were either bolted or welded in place as desired.

The maintenance electricians formerly had to use a long ladder to reach the control panel. This was done with considerable difficulty, since the doors had to be opened and closed with the ladder in the clear. Improvements for the benefit of the electricians included a rail enclosed platform at the proper elevation. This platform can be entered from the warehouse roof, thus eliminating the ladder. It is now possible for a mechanic to ride the crane as he makes the careful adjustments required on the multitude of relays, limit switches and reverse current relays.

The finishing touch consisted of an under coat of red lead, followed by aluminum paint.

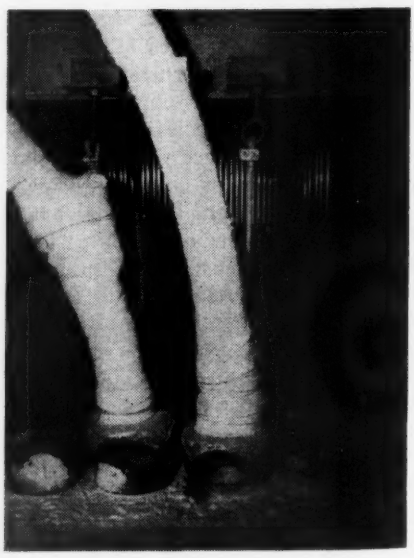
Steel Cables Support Primary Riser Cables

WIRING

Primary feeders to the numerous substations at Hotpoint's new range plant in Cicero, Illinois, consist of 3-conductor, lead-sheathed, 12,000 volt cables in 4-inch fiber conduits encased in a concrete envelope. These circuits are normally run underground, then go up as vertical risers in special concrete columns to feed the roof and mezzanine substations.

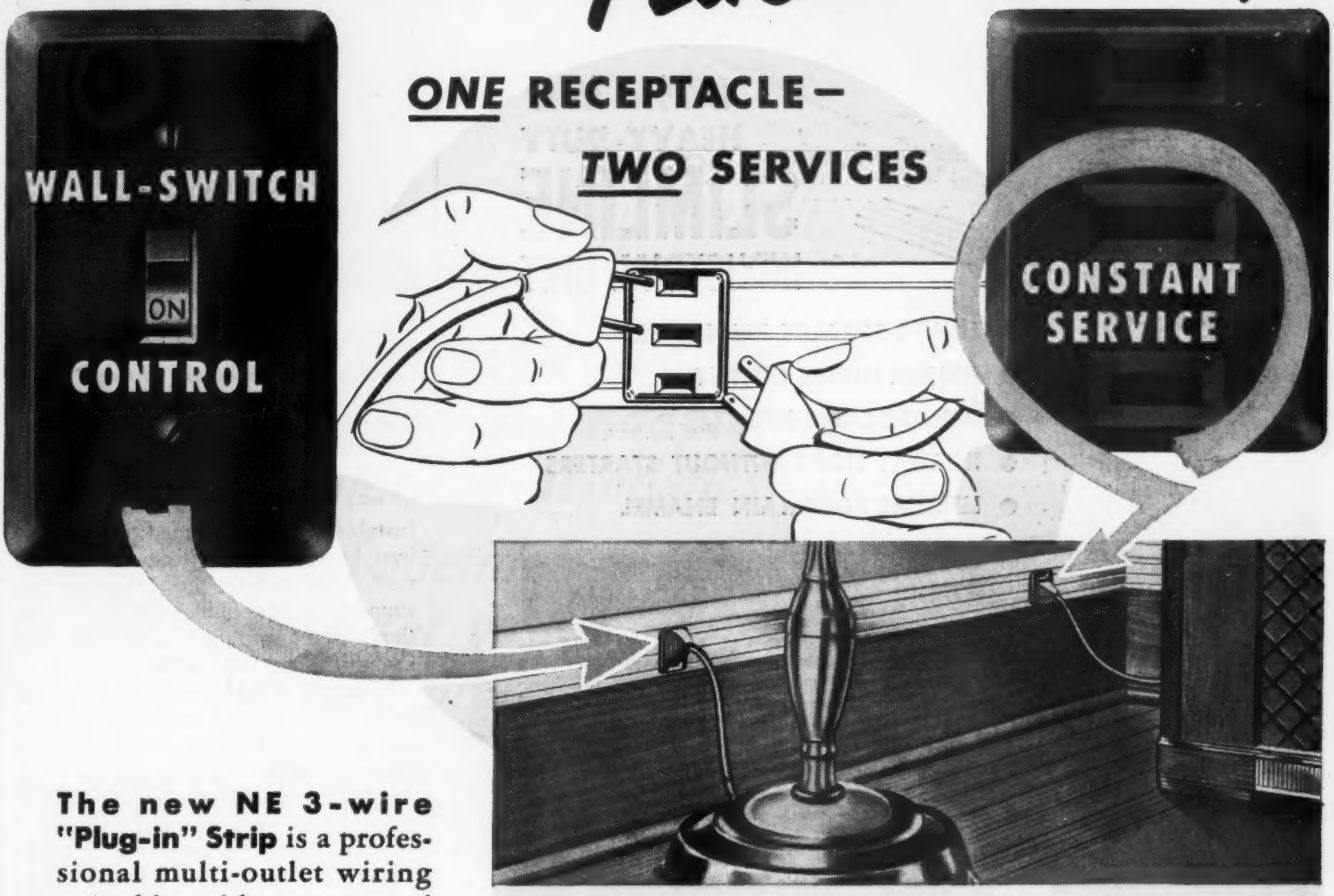
Lead cables of this size and capacity weigh quite a few pounds per foot. Unless adequately supported at terminal points, this weight of vertical risers can place considerable strain on pothead connections and may even damage the cable sheath.

Sweningson and Company, Chicago electrical contractors on the project, used steel cable supports to relieve any strain and carry the full weight of each riser cable. At points where the cable emerged from the concrete-enclosed fiber ducts, standard flexible copper band cable supports were wrapped around the lead sheath and clamped to a steel cable grip. One end of a ½-inch stranded steel cable was fastened



Short hitch supports on dual primary cables at point where they leave duct risers under roof substation to enter pothead enclosures.

NOW— a switch controlled "PLUG-IN" STRIP!



The new NE 3-wire "Plug-in" Strip is a professional multi-outlet wiring assembly with an unusual new feature: Instead of the usual two slots, each receptacle has three.

Appliances plugged into the top and center slots are controlled by doorway switches, while appliances plugged into center and bottom slots will operate independently of the wall switches. Thus, you can turn off all lamps at once, but leave the electric clock, radio, and other appliances running.

- **EASY TO INSTALL.** At last, full switch-controlled service of *every* outlet with minimum switch-leg wiring. No complicated behind-the-wall installations.
- **ARCHITECTURALLY CORRECT.** An unnoticeable steel baseboard trim.
- **SAFE FOR LIFE.** No soldered or screwed connections . . . a solid copper electrical system from switch box to the very last outlet. Tamper-proof because the capping is locked on permanently.
- **LISTED BY UNDERWRITERS' LABORATORIES, INC.**

Let us send you a copy of our booklet "The *New* Switch-controlled 'Plug-in' Strip," and the pamphlet "An Adequate Wiring Plan for Residential Wiring Modernization."

NATIONAL ELECTRIC PRODUCTS — WIRING SYSTEMS — WIRES AND CABLES

National Electric Products Corporation

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SILV-A-KING

OUT FRONT AGAIN!

with a NEW
HEAVY-DUTY
SLIMLINE
INDUSTRIAL UNIT

- LOWER SURFACE BRIGHTNESS
- HIGHER LUMEN OUTPUT
- LONGER LAMP LIFE
- INSTANT LIGHT *WITHOUT* STARTERS
- LIFETIME PORCELAIN ENAMEL

THESE CONSTRUCTION FEATURES TELL THE STORY!

- Newly designed one-piece, heavy gauge steel top channel. Individual mounting or continuous runs. Finished in gray baked-enamel to match top side of reflector. Immediately available in 8 ft. units — will be available in 4 and 6 ft. units.
- Slide-grip hanger groove running entire length of unit permits wide versatility of installation.
- Lifetime porcelain-enamel reflector, white inside, gray outside.
- New E-Z-LOK for split second assembly or disassembly of reflector from hood. No loose parts.
- New G. E. Turret Lampholders spaced 5 inches on center. Safety spring action eliminates possibility of lamps falling from vibration.
- High-power Factor ballasts. U. L. approved. Units fabricated and wired A. F. of L., I. B. E. W.

SLIMLINE INDUSTRIAL UNIT SPECIFICATIONS

	Cat. No.	Lamps	Miliamps	Voltage Cycles	List Price
Porcelain Enamel Reflector	2200P	2-51 watts 60 Lumens per watt	200*	110-125 volts 60 cycles	$67.50
	2425P	2-75 watts 64 Lumens per watt	425†	110-125 volts 60 cycles	$78.50

* Units equipped with 300 M A. ballasts can be supplied.
† As lamps become available, these units can be supplied in 4 and 6 ft. lengths.
Units can also be supplied with baked-enamel reflectors, at slightly lower prices.

WRITE FOR COMPLETE LITERATURE

SILV-A-KING LIGHTING EQUIPMENT

BRIGHT LIGHT REFLECTOR COMPANY
INCORPORATED
Subsidiary of Bridgeport Pressed Steel Corporation
FAIRFIELD and STATE, Bridgeport 5, Conn.
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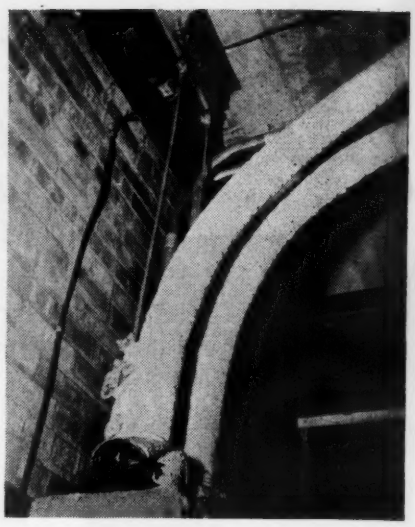
Cincinnati, Ohio	Kansas City, Mo.	Richmond, Va.
Cleveland, Ohio	Los Angeles, Cal.	San Francisco, Cal.
Dallas, Texas	Minneapolis, Minn.	St. Louis, Mo.



Longer supports on primary cables where they emerge from riser ducts to enter channel-iron "bridge" that carries them across room to roof substation above. Asbestos tape fireproofs lead sheathed cables.

to this grip; the other end to an adjustable eye-bolt mounted to an angle-iron bracket welded to the structural steel. The greater the tension on this supporting steel cable, the tighter the flexible copper band grips the lead sheath around the conductor.

Compound and heavy lead shields were placed around each cable where it left the fiber ducts to center the cable and keep gases from entering the ducts. All bare cable sections, from duct ends to potheads were wrapped with layers of asbestos tape to provide a fireproof covering. A 4/0 stranded bare copper ground conductor is encased in the concrete duct envelope and riser columns; is connected to the building steel at these riser support points.

Bus Tie Provides Emergency Connection

WIRING

At the Terrace Plaza Hotel Building in downtown Cincinnati, Ohio, two widely separated switchboards are fed by underground utility vaults adjacent to the switchboard rooms. Each vault has four 600-kva. transformers with an additional 200 kva. of network capacity (120.208-volt, 3-phase, 4-wire). One serves the air conditioning load; the other, the general power and light load.

Should the main switchboard vault

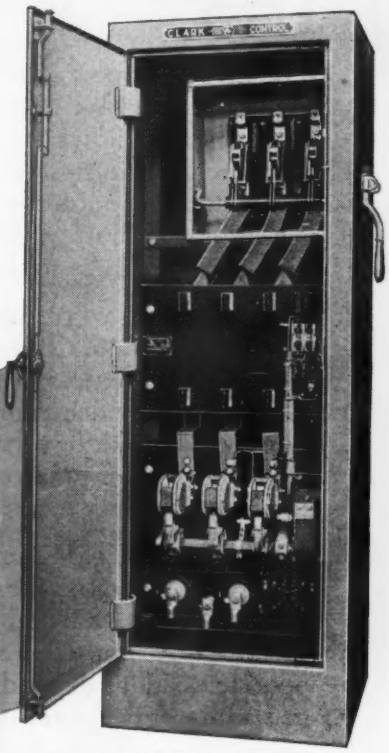
Don't Miss the New
READER SERVICE page 161

NEW! CLARK Bulletin 6018 Size 5 COMBINATION STARTER with THERMAL OVERLOAD RELAY

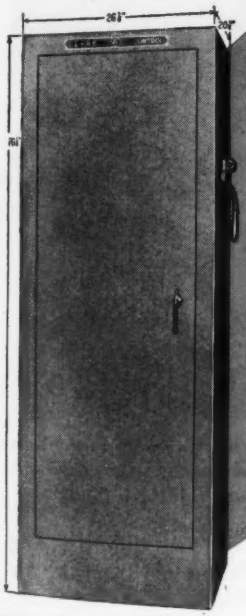
Starter and Safety Switch in one Cabinet!

Interchangeable Heaters for On-the-Job Adaptation to Motor Characteristics!

Clark Bulletin 7322 Overload Relays for positive thermal Overload protection!



Bulletin 6018 Size 5 AC Combination Starter. Non-Reversing Magnetic Starter with Disconnect Switch—Fusible. (Fuses not shown)



Closed view of Bulletin 6018 Size 5 Cabinet, with dimensions.

● In this new design, the formerly-used magnetic overload relay, which required factory pre-setting to specific motor characteristics, has been replaced with the sturdy CLARK Bulletin 7322 Thermal Overload Relay. This permits adaptation of the starter to various HP ratings in the field —by simply changing standard heaters. To accomplish this, current is reduced in the relay circuit by "Do-Nut" type transformers mounted on load terminals.

CLARK Bulletin 6018 starters have starter unit and safety switch mounted in the same cabinet, which is equipped with "pan-type" constructed doors for added strength and rigidity. Starters with fusible or non-fusible disconnect switches are available. Floor-mounted cabinet provides plenty of wiring space.

Your nearest CLARK distributor can supply you with these new starters.

THE CLARK CONTROLLER CO.

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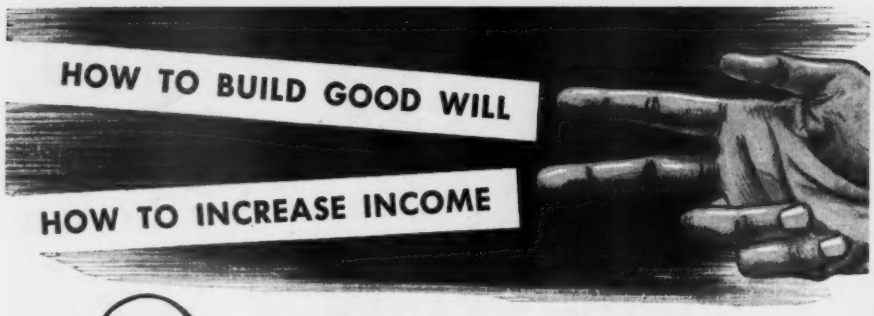
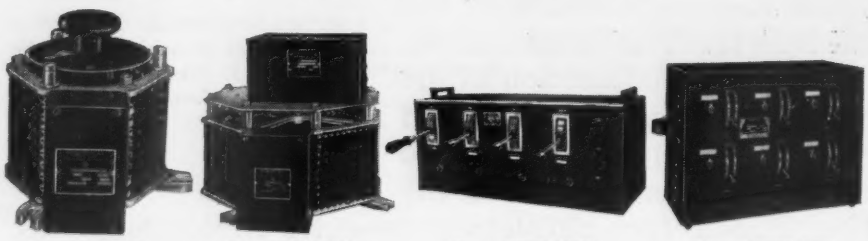


2 TIMELY TIPS . . .

1. A theatre equipped with modern, flexible lighting facilities can build good will and increase income through added off-hour use. Either by conversion, or by incorporating these facilities in new structures, any movie house can, in its off-hours, double as a place of assembly for a wide variety of community affairs, charity drives, rallies, lodges, clubs, open forums and similar events.

2. Civic meetings, conventions and even church services during off-show hours can add revenue and local stature — especially to theatres in suburbs, neighborhoods and small communities which cannot ordinarily afford civic auditoriums used only a few days a month. The use of theatres for such purposes can prove economical to sponsoring groups and profitable to theatre ownership and management.

POWERSTAT Light Dimming Equipment can help make any theatre suitable for these off-hour uses. With it, stage or houselights can be brightened, blended or dimmed to suit the occasion. It is easy and economical to install and operate. And it's dependable — built to withstand constant use and to give years of trouble-free service.



Type D1700 Type DM4600 Type DBP3-1700 Type DBR6-850

POWERSTAT Dimmers are designed for manual or motor-driven operation, for direct or remote, pushbutton control.

We'll be glad to send complete information on how **POWERSTAT** Dimmers can be used in your theatre. Write us today.

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THE SUPERIOR ELECTRIC CO.
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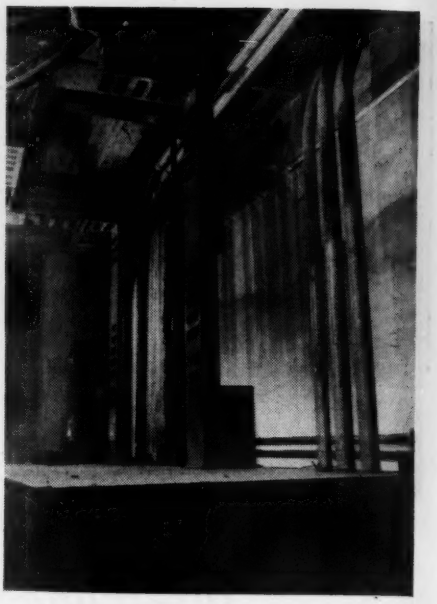
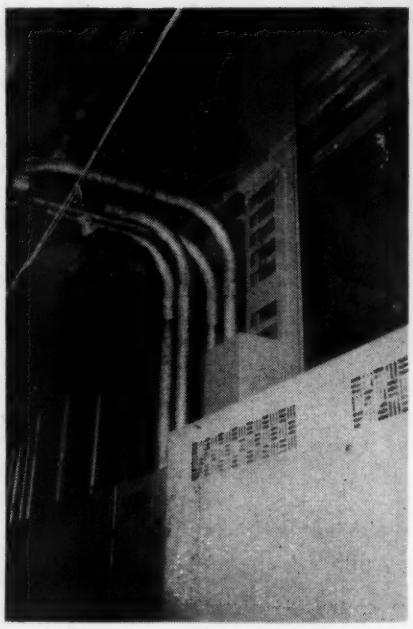
POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLIES • STABILINE VOLTAGE REGULATORS



Top of board in air conditioning room showing other end of 1,600-amp. emergency bus tie in foreground. Other bus circuits serve large refrigeration equipment motors.



Emergency bus tie leaves top of main switchboard and weaves up through maze of secondary conduit feeders.

go out, the emergency lighting and power circuits can be fed from the air conditioning switchboard. This is accomplished by a 1,600-amp., 4-pole, low-impedance bus duct tie between the two boards. A three-section automatic transfer switch cubicle in the main board automatically cuts in the emergency lighting for the hotel and store areas. Electrical installation was made by Bertke Electric Co., Cincinnati, Ohio.

The arrangement guarantees both service and safety to hotel residents in the Terrace Plaza.

Built to look out for themselves no matter how tough the going...

HAZACORD
portable cords and cables

For a giant electric shovel, a portable tool, machine or light — for any of today's many uses of portable cords and cables, Hazacord is used for good reasons.

The Hazaprene tough jacket is an especially formulated compound that brings out the optimum physical properties of its basic ingredient: neoprene. This jacket successfully resists oil, grease, solvents, acids, water, sun, flame, etc. And just as important, it withstands twisting, heavy blows, scraping, stretching, and other possible mechanical damage.

The extra-flexible conductors are made of soft annealed copper, tin coated for ease in making soldered connections. Insulated with a Hazard rubber compound that's strong, flexible and long-lived, Hazacord assures you excellent electrical as well as mechanical protection.

You can get most Hazacord sizes today from your electrical supplier's stock. If he shouldn't have what you need, write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

ALL HAZACORDS MOLD-CURED FOR LONGER SERVICE

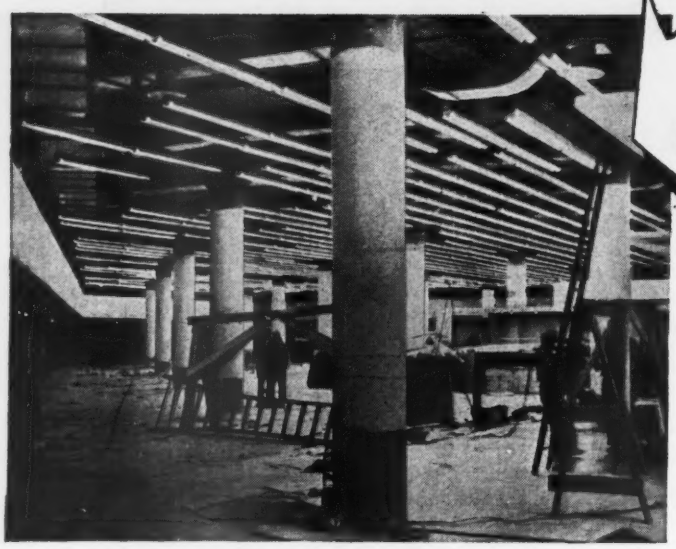
HAZARD

6305

insulated wires and cables for every electrical use

Facts you'll want to have about a basic advance in LIGHTING

The Sylvania "Flexi-Module" System of LOUVERED CEILING LIGHTING effects big economies in building costs



No need for expensive buried-in-concrete construction

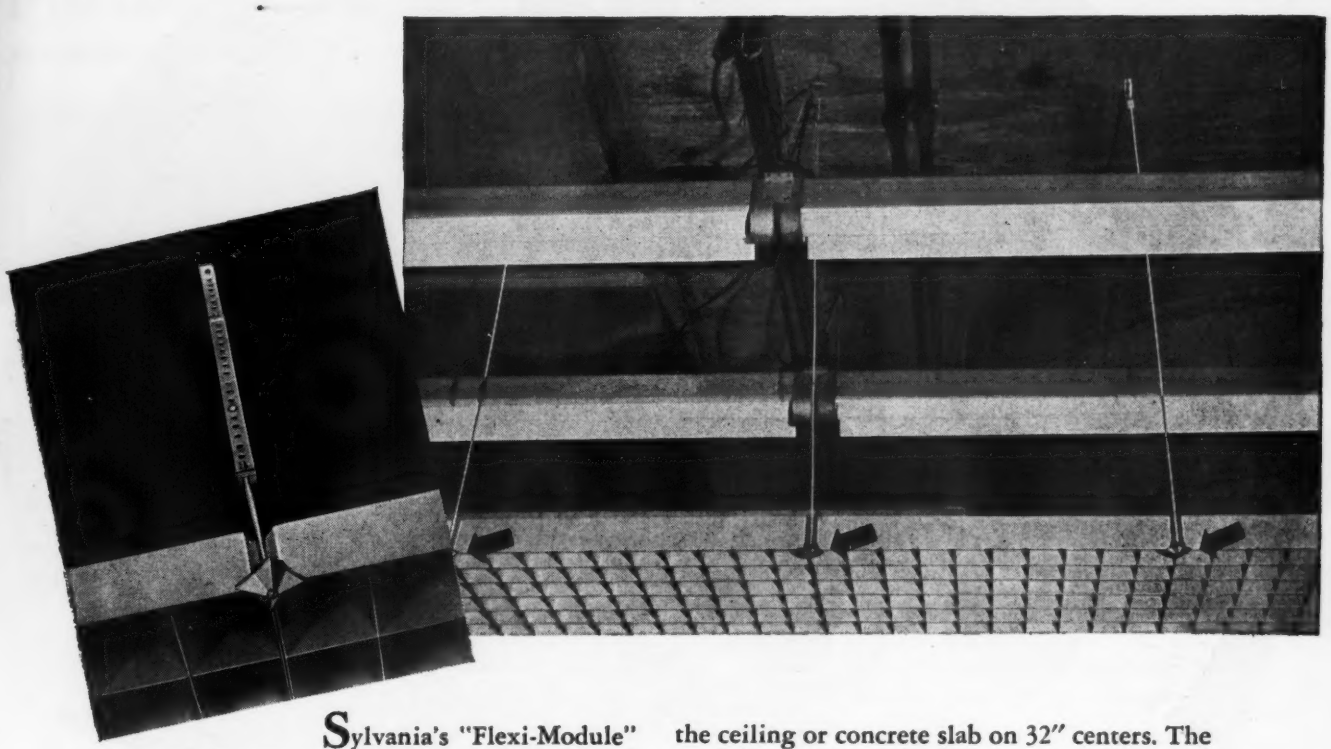
You'd naturally *expect* the last word in modern, flexible lighting systems to cost *more* money than other types. But the Sylvania "Flexi-Module" System of louvered ceiling lighting actually costs less! With the Sylvania System, there's no need to incur the expense of running pipes, ducts and conduits through concrete or plaster. They can be run in the open—*under* the concrete ceiling slab. Low-cost sprinkler heads can be used, instead of the much more expensive ones commonly used for decorative purposes alone.

LOUVERED CEILING hides ducts and pipes!

Once the louvered ceiling is in place, it conceals all the ducts and piping, as well as the inexpensive sprinkler heads. By simply lifting out any number of the ceiling sections, the utility services are easily accessible, reducing the cost of repairs or changes. A still further saving results from the elimination of decorating costs. The hidden ceiling requires no painting.

EASILY MAINTAINED. Dust doesn't collect on the non-static aluminum louvers . . . finger prints do not show due to the protective plastic finish over the aluminum.

See how simple the Sylvania System is!



Sylvania's "Flexi-Module" System is the secret . . . it consists essentially of fluorescent fixtures supported by chains, and suspended above a ceiling composed of 32" by 32" aluminum louver units. Power for the fixtures is supplied by standard plug-in duct wiring system. This allows complete freedom in arranging or relocating fixtures to meet changing lighting requirements. The modular panels permit of a wide variety of architectural treatments, including checkered, striped, diagonal boxed and other patterns.

INSTALLATION OF LOUVERS IS EASY

The Sylvania System requires no costly *subframe* of channels or other devices. The adjustable hangers are easily and quickly attached to the ceiling or concrete slab on 32" centers. The modular panels are then dropped into place, and are engaged by the specially designed suspension units (see enlargement of suspension units). Louvered sections are then leveled by simply adjusting the units from below.

The lighting fixtures and panel hangers may be hung either from continuous channels on the surface of an existing ceiling or from standard channels set into the structure. These members may also be used for supporting ducts, sprinklers and other utilities.

The Sylvania "Flexi-Module" System is just as simple as that! You'll want the *full* story on this modern, completely flexible, money-saving lighting system!

Mail coupon for full information ➧➧➧

SYLVANIA ELECTRIC

FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, SIGN TUBING; LIGHT BULBS; PHOTOLAMPS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

Sylvania Electric Products Inc.
Advertising Dept. L-6009
500 Fifth Avenue, New York 18, N. Y.

Gentlemen:

Please send complete information on the Sylvania "Flexi-Module" System of louvered ceiling lighting, together with data on Sylvania Lighting Products.

Name.....

Address.....

City.....State.....

Frictionless as Flight!

Only Federal Noark Motor Starters have free action . . . the one moving unit floats on ball bearings

YOU DON'T SEE the ball bearings, but push up that moving unit and you *know* they're there. Only a featherlight touch is needed! And only Federal Noark Motor Starters give you that floating ball bearing action—with consequent longer and trouble-free service life.

But chalk up too, these additional advantages of Federal Starters! Their overload relays allow you the choice of automatic or manual reset by merely turning a knob. Coils are replaced in a matter of seconds. All parts are readily accessible from the front.

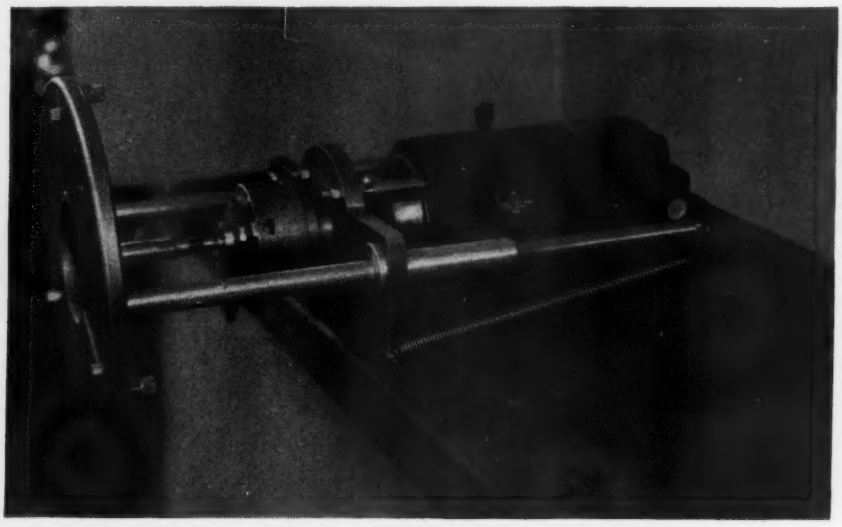
Order Federal Noark Motor Starters from your Federal Distributor and save time, effort and money. And write us for free copies of the "Federalog" and "Simplified Motor Control" giving full descriptions. Federal Electric Products Company, 50 Paris St., Newark 5, N. J.

FEDERAL NOARK

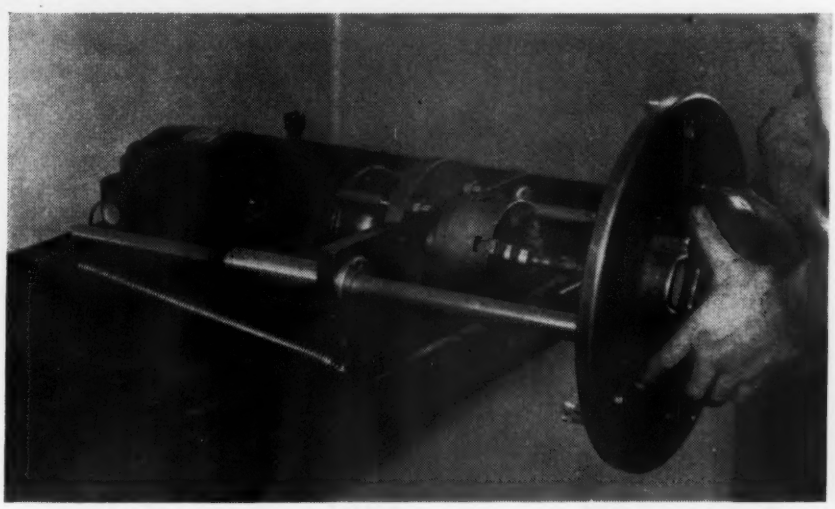
MOTOR STARTERS

Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

Motor Shops



Power driven line reamer constructed with a gearhead motor, tool chuck, and end bell face plate on spring-return plunger rods.



End bell centered on face plate is pushed into rotating reamer. Coil springs return face place to original position.

Power Driven Line Reamer

The kilowatt has taken over another chore in the shop of the Tennessee Electric Motor Service at Knoxville. Horsepower has replaced hand power for line reaming sleeve bearings in all conventional and many special type motor end bells.

Designed, built and used by the Knoxville shop, the power reamer is constructed around a horizontal gearhead motor with an 84 rpm. shaft speed. Mounted to this shaft is a lathe-type chuck that holds the reamer tool. A heavy steel plate yoke, bolted to the gearbox frame, supports a tubular metal collar on each side of the rotating chuck. Through each collar slides a round steel plunger, one end of which is attached to a heavy coil spring mounted to each side of the supporting yoke. The other end of each plunger arm is attached to a round, vertical steel face plate with a center opening to permit passage of the reamer. Three long slots, on 120-degree radii, accommodate adjustable "jaws" that center the motor end shield on the face plate.

To ream a bearing, the mechanic centers the end shield on the face plate. When pressure is applied to the end bell, the face plate moves into the slowly rotating reaming tool against the "pull" of the coil springs. Once the reaming is completed and hand pressure is released, these springs return the face plate to its original positon. Bearings in end frames up to 12½-inch diameter can be reamed.

Shop personnel at TEMS say their power driven line reamer has the following advantages:

1. Is easy to adjust.
2. Line reams all sleeve bearings in all conventional and many special types of end frames.
3. Is quicker than free-hand reaming.
4. Requires no skilled operator.
5. Requires no bolts, clamps, or magnetic check to hold end bell.
6. Produces a perfect line reamed bearing.

This shop idea won honorable mention in the 1948 NISA Award Contest. Release and publication is through the courtesy of the 1948 Awards Committee of the National Industrial Service Association.

Positive Heat With Electric Ovens

Exact temperatures are maintained in the four electric ovens of the Erie Electric Company, Buffalo, N. Y., by automatic thermal and time controls

Coils are suspended in 300 cu. ft. baking oven, utilizing electric heating coils as heating element. Double ¼-inch shell is insulated with rock wool and asbestos.

CONTRACTORS:

MAKE EASY EXTRA PROFITS FROM TIMESWITCH SALES

GENERAL ELECTRIC TIME SWITCHES **are easy to sell as "extra-profit" items along with most of your regular jobs. Wherever an electric circuit needs to be turned on and off repetitively, there's an opportunity for you to make a sale. Customers appreciate the convenience, economy, and safety of G-E time switch control.**

HAVE YOU CONSIDERED THESE POSSIBILITIES—AND POINTED THEM OUT TO YOUR CUSTOMERS?

G-E Time Switches for . . .

Store window lighting
Electric sign control
Refrigeration defrosting
Electric appliance control
Apartment hall lighting
Factory yard lighting
Heater and cooling control
Public building lights
Conveyor, fan, solder-pot, or oven control in factories

There's a G-E time switch for each of these jobs, and others that may tie right in with construction you're doing now.

Type T-47 Handy Time Switch is best for single on-off operations. It repeats a cycle (minimum on 5 min., maximum 22 hrs.) every 24 hours. Only $10.98 list.

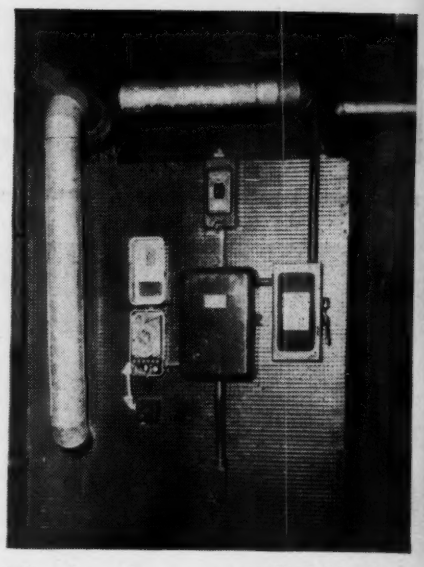
Type T-27 is the "complete" time switch. It's easily adjusted for any daily schedule, even a constantly changing dawn-dusk arrangement (with astronomic dial). It also can be furnished with an omitting device to make it skip certain days. Prices are from $25.50 list. Both switches have large silver contacts and reliable Telechron® motors.

EASY INSTALLATION—**Roomy wiring space, simple knockouts, and a mechanism that need not be removed from the case helps simplify your installation job.**

Start adding this easy, extra profit to your regular jobs. Get a supply of G-E time switches from your nearest distributor. If you want more details, write for Bulletin GEA-3339 (T-27) and GEA-4874 (T-47). *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

603-80



Electric units are controlled for both temperature and time intervals. Exhaust fan removes volatile gasses from curing chamber and maintains positive circulation.

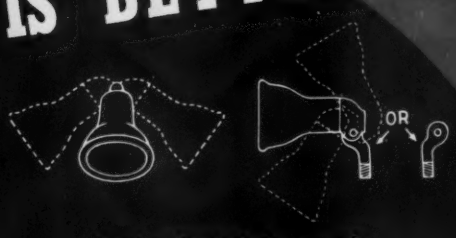
that activate the electric heating units mounted on the walls of the enclosed units. Exhaust fans maintain positive circulation for the curing chambers, while double steel shells and complete insulation confines heat within the baking space. Shells are of ¼-inch steel and insulating materials are rock wool and asbestos. Ovens, designed and constructed in the Erie shops, are proportioned and equipped for the various operations in specific areas, such as stator baking, coil insulation, transformer coil preheating and so on. Operating personnel state that these electric units are more positively controlled and achieve more thorough curing than was possible with other types of heating units formerly employed in the Erie plant.

Lathe Jig For Milling Commutators

Relatively few of the so-called "average" motor repair shops are fortunate enough to have a milling machine. Yet, almost all of them have had occasion, at one time or another, to mill commutator slots for new and larger lead wires, or to clean out solder, or to make the old slots wider or deeper, whatever the job required. Normal practice would be to job out this work or try to do it with a hacksaw. The latter is time consuming and sometimes questionable from the standpoint of quality workmanship.

Erik Gyllenberg, supervisor of the mechanical department, Electrical Installation Company, Cambridge, Mass., solved this problem by designing an attachment for milling commutator bars on a standard lathe. His idea

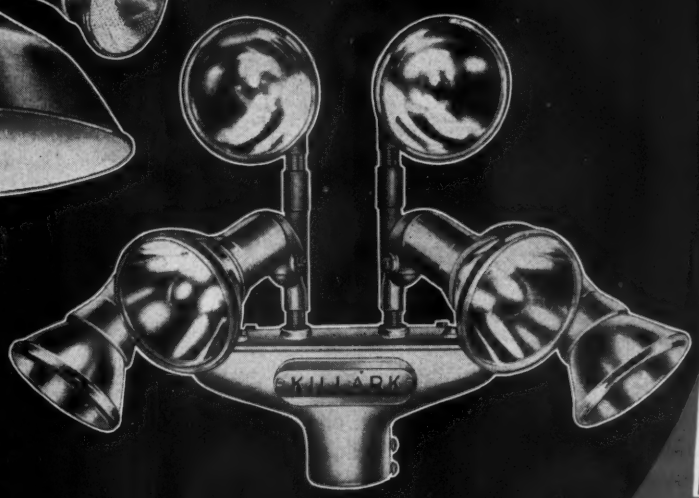
BUSINESS IS BETTER with



Can be directed at any angle.
Can be adjusted up or down.

TYPE SMHU

With 1 to 6 lamps. Can be used with your present island light set-up.



TYPE SYL

Available with 2 to 6 lamps.

KILLARK CLUSTER LIGHTS

Better Lighting . . . Easy Installation!

"Tailored" to give efficient and economical lighting for every need, Killark Cluster Lights offer all these PLUS features — that add up to better lighting for your customers — better business for you!

+ Special sealed beam lamps in all fixtures.
+ Each lamp is adjustable, to give light where it's needed most.
+ Uses MEDIUM BASE 150 and 300 watt lamps and MOGUL BASE 300 and 500 watt lamps.
+ Rustless aluminum construction, for dependable service.
+ Weatherproof — sealed against dirt, dust and moisture.
+ Low maintenance cost — no reflectors to paint or wash.

Trough large size. Front (gasketed) cover for easy splicing and wiring.

From single Killark Sealed Beam flood or spot lamps to six lamp Cluster Lights, Killark offers a unit for every need. Furnished completely wired for simple, fast installation.

Write for illustrated bulletin and information on the complete Killark line.

K KILLARK ST. LOUIS

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ELECTRIC MANUFACTURING COMPANY

Offices and Warehouses: Atlanta, Boston, Chicago, Denver, Los Angeles, Pittsburgh, San Francisco, Seattle, Syracuse.

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FOR EVERY JOB
For Safe
Dependable Operation
Use

BRONCO 60

CORDS and CABLES
With the Dupont Neoprene Jacket

FLEXIBLE

TOUGH

DURABLE

For high speed production . . . on construction jobs . . . in industrial plants wherever electrical cords and cables are needed for portable tools and power equipment, BRONCO 60 can be depended upon for long, safer, dependable operation.

Flexible so that it lays flat and does not kink or tangle. Wear resistant because its Dupont Neoprene Jacket makes it resistant to heat, oil, grease, chemicals and abrasions. It stands up month after month under the toughest conditions. Electrical cord and cable failures mean costly work shutdowns . . . eliminate them by using BRONCO 60 on every job.

See Your Wholesaler today and see why BRONCO 60 is the better wire to buy.

WESTERN INSULATED WIRE CO.
1001 EAST 62nd STREET • LOS ANGELES 1, CALIF.

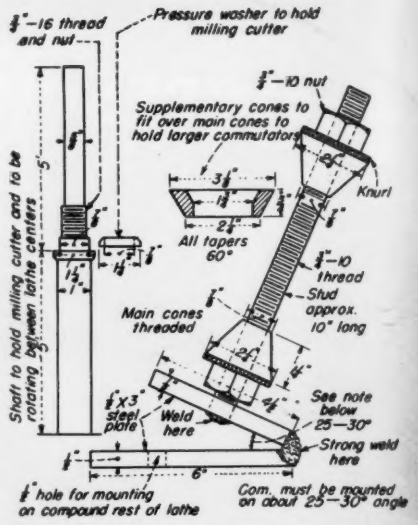

Pressure washer to hold milling cutter
Supplementary cones to fit over main cones to hold larger commutators
Knurl
All tapers 60°
Stud approx. 10" long
Main cones threaded
Shaft to hold milling cutter and to be rotating between lathe centers
See note below
25—30°
Weld here
Strong weld here
Com. must be mounted on about 25—30° angle

FIG. 1—Design details of parts that comprise the lathe jig for milling commutator slots.

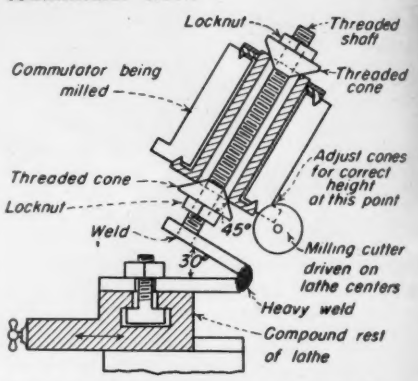


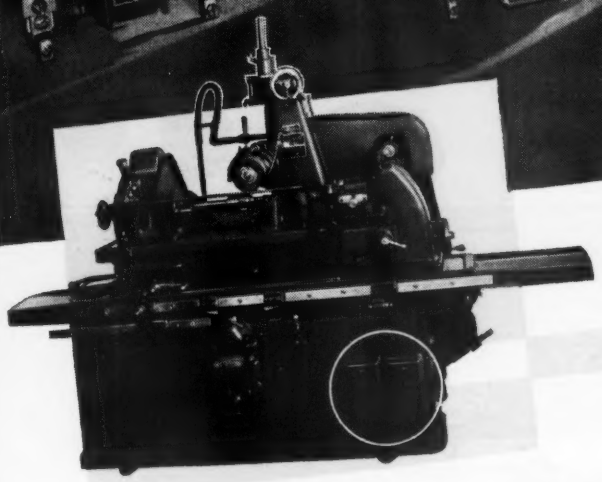
FIG. 2—Sketch of jig mounted on lathe with commutator in position for milling operation.

warranted honorable mention in the 1948 NISA Award Contest and is published through the courtesy of the 1948 Awards Committee of the National Industrial Service Association.

The jig is mounted to the compound rest of the lathe; holds the commutator at an angle of 30 degrees to the horizontal so lead slots can be cut by milling cutters mounted to a shaft rotating between the lathe centers.

Base of the attachment is a 6-in. by 3-in. by ½-in. steel plate with a hole for bolting to the lathe rest. Welded to this base is a 3-in. by 3-in. by ½-in. plate tilted at an angle of 30 degrees. This has a threaded hole that accommodates a 10-inch long, ¾-inch diameter, threaded stud on which the commutator is mounted. Two steel cones, machined from an old shaft and tapped to fit the threaded rod, seat and automatically center the commutator. The vertical position of the commutator (height on the rod) can be adjusted by turning these cones. After being set just tight enough to permit hand turning of the commutator to position the slots, these cones are locked in place by locknuts. Construction details of the jig are shown in Figure 1.

DESIGN LEADERSHIP



SQUARE D MOTOR STARTERS

SQUARE D's DESIGN LEADERSHIP is reflected in important features: Generous wiring space . . . simple contact change . . . easy coil removal . . . additional electrical interlocks . . . long life . . . NEMA standardization . . . simplified maintenance. These are features which add up to an ever-increasing preference for Square D motor starters.

Write for BULLETIN 8536.
Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin

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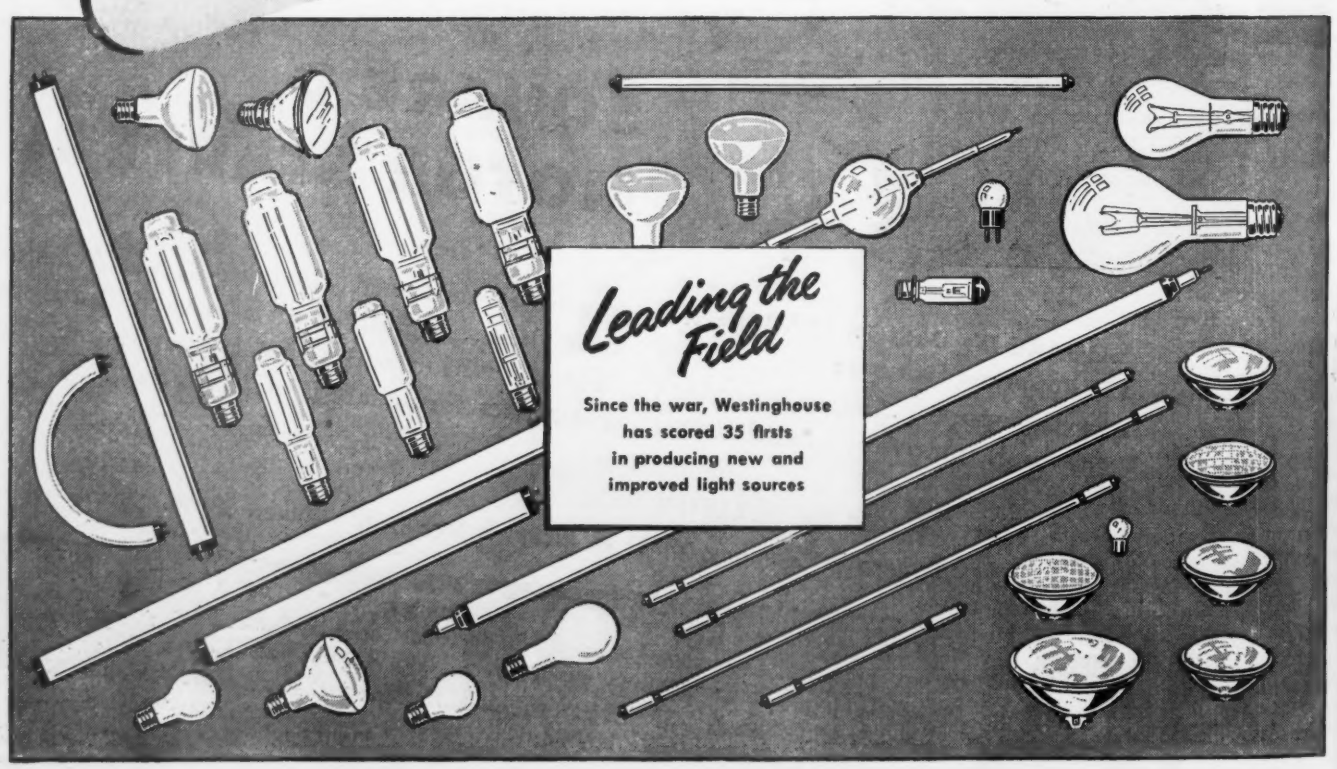
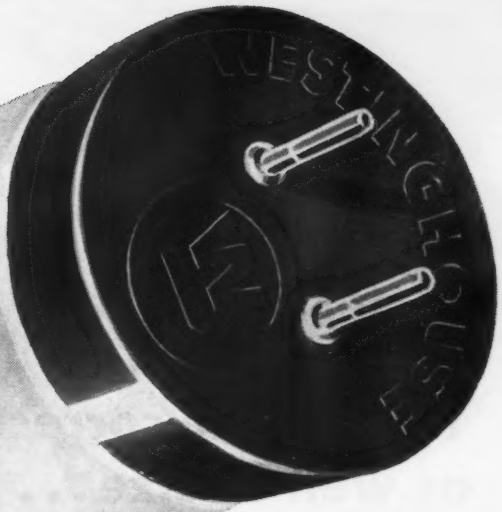
Westinghouse

Fluorescent Lamps

NOW LAST 3





TIMES AS LONG!

...YET COST NO MORE!

SAVE 2/3

SAVE THIS — one lamp now lasts as long as 3.

LAMP COSTS

TIME SPENT REPLACING BURNED OUT LAMPS

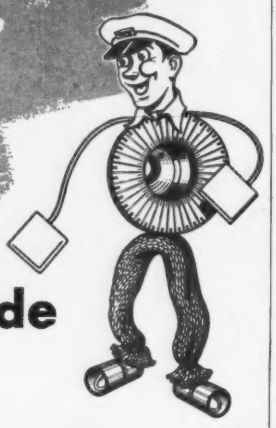
SAVE THIS — lamps need be replaced only ⅓ as often.

Now Westinghouse fluorescent lamps will last 2½ years in average store installations . . . 3 years in average one-shift office or factory installations.

This amazing increase in life was engineered into Westinghouse fluorescent lamps many months ago. Since then they have been under strenuous life tests —tests that cannot be hurried. Now the results are in and they prove that Westinghouse lamps last three times as long as before! Lamp Division, Westinghouse Electric Corporation, Bloomfield, New Jersey.

YOU CAN BE SURE... IF IT'S Westinghouse

Genuine Joe says--



You get the correct grade as well as size...

WHEN YOU BUY *Genuine* Wagner BRUSHES

Brushes furnished in Wagner Motors are the finest obtainable. When you replace them use *genuine* Wagner brushes . . . *BEST* because Wagner *correct grade* brushes give maximum performance, commutator and brush life.

Identify them by the name WAGNER appearing on the brushes.

Write for CATALOG MU-40

Every repair shop needs one. It helps determine the catalog number and price of Wagner Motor Parts.

These signs identify Wagner's nationwide network of 450 Authorized Service Stations and Parts Distributors. They mean that a complete stock of *genuine* Wagner motor replacement parts is available to fill your needs.

Wagner Electric Corporation EST. 1891

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M549-4

ELECTRICAL EQUIPMENT AND AUTOMOTIVE BRAKE PRODUCTS

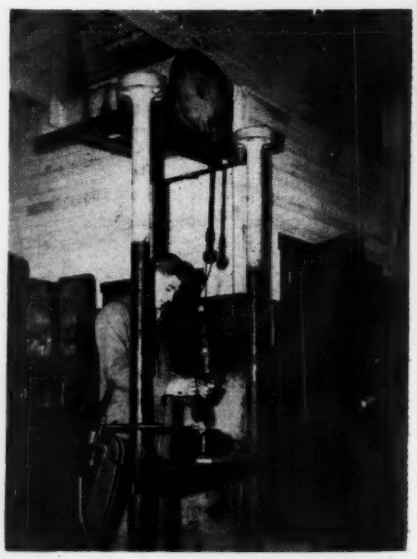
Milling cutters are mounted singly, or ganged, on a 10-inch long shaft that rotates between the lathe centers. The lathe hand feed is used to move the commutator into the cutters.

When larger commutators are involved, supplementary adapter cones are placed between the commutator and main cones on the jig shaft.

Electrical Installation Company finds this jig increases the value of the conventional lathe to their shop.

Motorized Eccentric Pulls Damaged Coils

Pulling damaged coils from stator slots prior to rewinding is facilitated in the shop of the J. L. Hemphill Company, North Bergen, N. J., by a motor driven eccentric mounted above the coil stripping table. The revolving eccentric raises and lowers a lever arm, to which is attached a pair of stripping tongs through short lengths of cable. Coils are grasped by the tongs while the ecccentric is in the lowest position and, as the eccentric revolves, the damaged coils are pulled clean. The overhead motor is regulated by a remote-control foot switch so that the operator can stop the eccentric in any position or inch the arm up or down slowly. While coils are being removed, stators are held securely to the stripping table by J-bolts passing over the rim of the stator and down to the supporting channel frame. Andrew Heck, in charge of this equipment, finds that coils are pulled cleanly and, since the force is directly upwards, slot ends and edges are undamaged during the stripping operation.



Andrew Heck pulls damaged coils from stator slots by grasping coils with tongs which, in turn, are pulled upwards by cables attached to lever arm on motor-driven eccentric connection. Foot lever regulates motor action, providing exacting control to operator.

Triangle's

"TRIOPRENE"

High Performance Neoprene Jacketed Cable

for

DIRECT BURIAL...DUCT SYSTEM ...AERIAL INSTALLATIONS

that are

More Flexible . . . Lighter . . . Longer Lasting . . . Easier to Handle

— at substantial savings in cost!

Here's what Triangle's "Trioprene" special cable means to you:

- **Greater Flexibility.** No metal tapes, no lead sheath, no confining braid — just f-l-e-x-i-b-l-e rubber insulation, f-l-e-x-i-b-l-e "Trioprene" jacket!
- **Smaller Diameter.** Elimination of customary layers of tape, braid and armor saves space — with no sacrifice of protection!
- **Lighter Weight.** The only metal is the copper conductor . . . weight is cut to the bone!
- **Non Magnetic.** No steel is used in "Trioprene" jacketed cables.
- **Easier Handling — Easier Splicing.** You don't have to wrestle with "Trioprene" cables! Because they are lighter, smaller, more flexible — they handle as easily as building wire.

. . . and in addition . . .

- **Lower Cost.** Where economy must be achieved with no sacrifice of quality, compare the cost of the cable, the freight, the labor for installing — then "Trioprene" jacketed cables are the answer!

For EXTRA quality — at NO extra cost — insist on "TRIOPRENE"!

I.P.C.E.A. TYPE RR . . .
U.L. TYPE USE

"Trioprene" Parkway Cable, Type RR, is available in sizes from No. 14 to 500,000 C.M., for operating potentials up to 5,000 volts. "Trioprene" Underground Service Entrance Cable, Type USE, is made in sizes from No. 14 to 500,000 C.M., for potentials up to 208 volts to ground.

If It's "Trioprene" It's Made by Triangle . . .
If It's Made by Triangle IT MUST BE RIGHT!

For full information, contact your nearest Triangle distributor or representative, or write

TRIANGLE CONDUIT & CABLE CO., INC.
190 Jersey Avenue • New Brunswick, N. J.

ARTERIES FOR ELECTRICAL SYSTEMS — INCORPORATED

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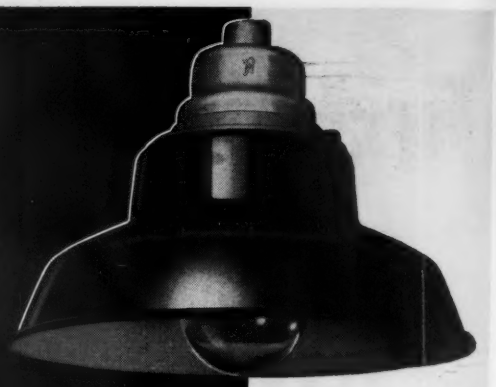
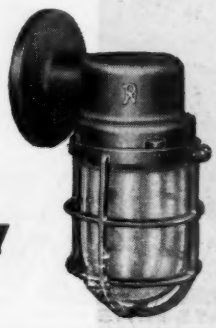
"GLAZON" BUILDING WIRE • BARE WIRE • ARMORED CABLE • "GLAZON" TRIEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED, TRIOPRENE TRENCH, POWER AND PARKWAY CABLES • RIGID CONDUIT HOT-DIPPED GALVANIZED • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT

Specify Vaportight *lighting* PYLETS





for *added* protection

For any indoor or outdoor location subjected to heavy concentrations of non-flammable vapors, gases, dusts or moisture, Pyle supplies a complete line of the highest quality industrial lighting fixtures delivering dependable and efficient illumination. Under these conditions vaportight lighting Pylets have an exceptionally long service life due to their heavy duty construction and especially efficient sealing features.

Bases are available in galvanized cast iron, aluminum alloy and bronze. Receptacles in porcelain and heavy duty molded bakelite. The bases have a large wiring chamber which remains vaportight even though the glass globe is broken or removed. The heavy guards, with or without shields, snap into a taper on the base and may be turned and locked in any position.

The superlative Pylet line for lamps from 10 to 200 watts includes a complete selection of hub arrangements, with or without a switch; varied types for conduit, outlet box, surface, wall and handrail mounting; single, two and three gang fixtures; four reflector styles; portable hand lamps; and midget fixtures for 10 watt lamps. Consult your Pylet catalog 1100 for complete listings.

SINCE 1897

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Industrial Electrification

Underfloor Distribution—Part I

The advantages, design, layout and specification of underfloor wiring systems are analyzed for the electrical engineer, contractor, building owner and tenant.

FOR several decades, construction trends have been towards simplicity. This has resulted in the development of modern commercial structures consisting essentially of outside shells, floor slabs, interior bearing columns, and only such partitions as are required to segregate stairways, shafts, service sections and utility areas. This has resulted in far greater latitude in space sub-division, for separation partitions can now be positioned and relocated in accordance with specific requirements of tenants or departments.

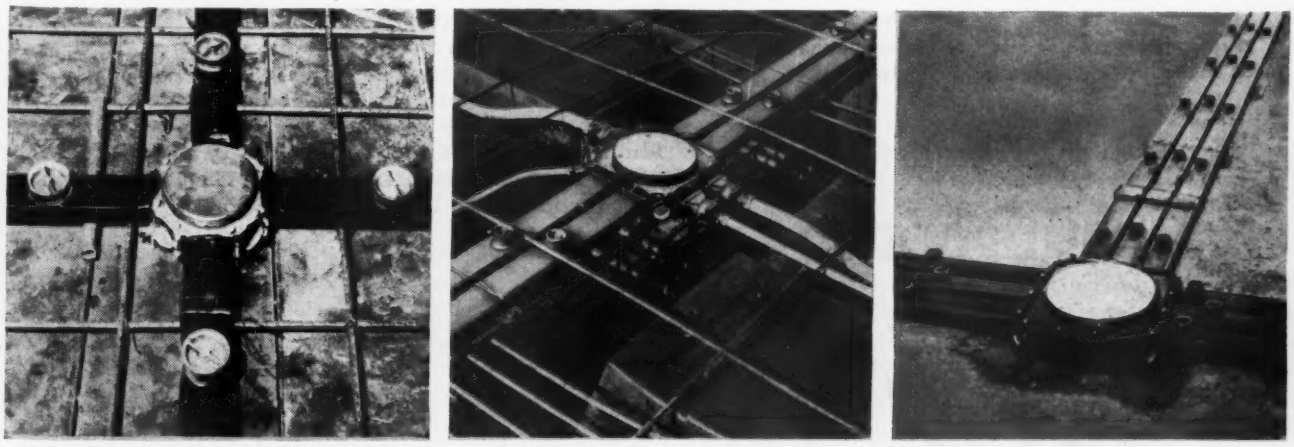
But although flexibility was thus obtained in the sub-division of floor areas, the problem of electrical distribution was introduced. For permanent partitions formerly had carried the necessary convenience outlets for power, telephone and signal systems. Of course, by locating outlets in outside walls and in columns, receptacles still could be located throughout the buildings independently of partition positioning, but these outlets frequently interfered with subsequent structural changes, and floor areas not immediately adjacent to columns or exterior walls were difficult to serve.

In certain cases, where service requirements were permanently located, sub-floor conduits were extended to serve these specific locations, and floor boxes were positioned as new requirements dictated. So logical was this floor-routing solution that the practice rapidly developed into the preplanned floor distribution systems which we have today.

PURPOSE AND RESULTS

Modern floor distribution systems fill several definite needs in the up-to-date office building. They care for the constantly increasing demand for conveniently-located outlets for the operation of telephones, buzzers, telegraph signals and other business devices and machines requiring electrical current. They provide for the constant change in office layout necessitated by fluctuations in departmental activity, methods and personnel. They eliminate unsightly and dangerous extension cords, keep walls and ceilings free of outlets, and generally improve the appearance of businesslike neatness. They provide for maximum space conservation. And, by eliminating the necessity for constant re-routing of conduits, they make a positive contribution to maintenance and management economy.

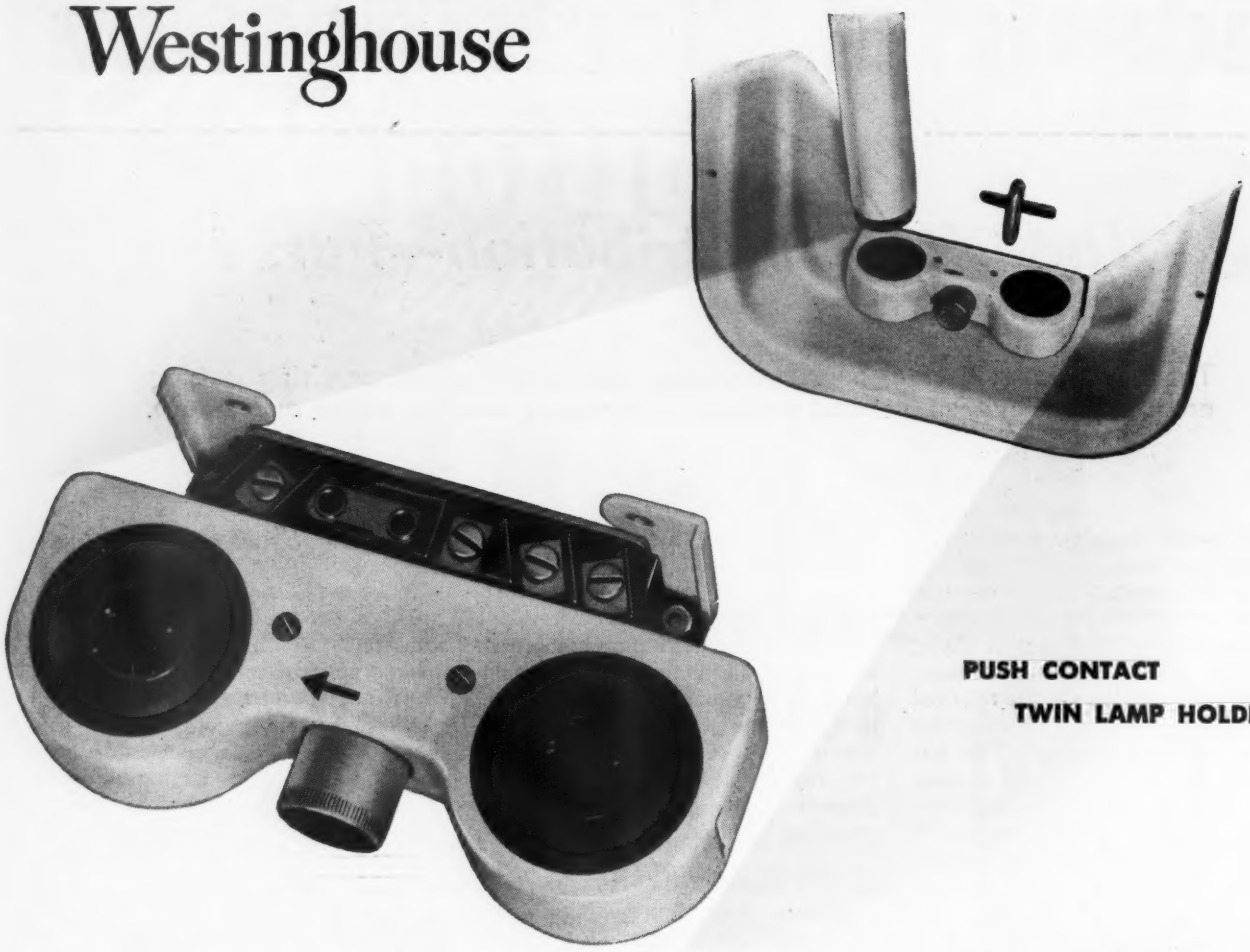
Underfloor raceway networks can be installed as single, double or triple-duct runs, all three having standard junction boxes. In this way, power, light, telephone and signal systems can be confined to separate channels. Connections of floor outlets can be made through inserts cast in the floors, directly into underfloor raceways, or rigid conduit branches can be run from the junction boxes. Floor outlets can be established in accordance with a pre-installation pattern, at regular intervals, and can either be located for use or covered as requirements are altered. With these continuous, concealed raceways having outlets for all required service wiring, connections between centers of distribution and points of utilization can then be established without disturbing the floor



***UNDERFLOOR SYSTEMS** can be installed as single, double or triple-duct runs, making it possible to adjust wiring densities to service demands while segregating power, light, telephone and signal systems in separate channels.*

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



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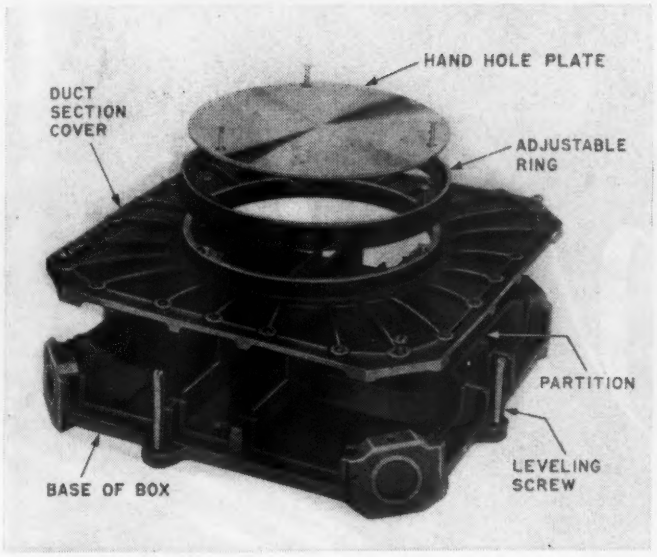
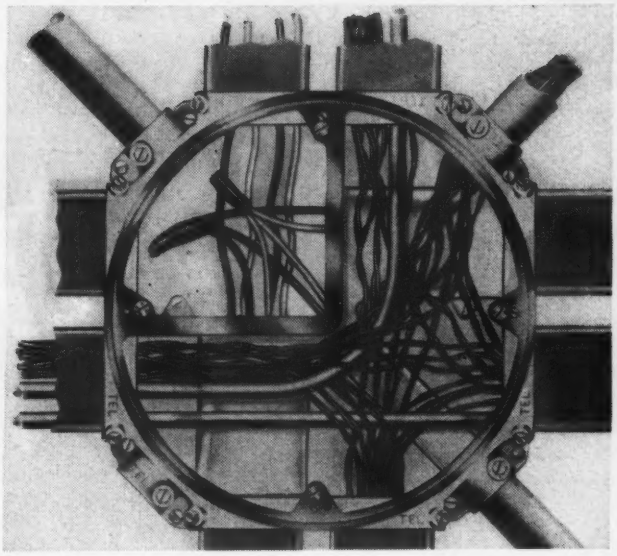


***JUNCTION BOXES** permit the crossing of ducts, provide for access to wiring, and facilitate connections of wiring systems to distribution centers.*



***TWO WIRING LEVELS** segregate high and low tension systems, while wide radius inside box facilitates the pulling of lead-covered cables into channels.*

structure or without interfering with normal business.

To anticipate expansion or rearrangement of systems, it is usually expedient to install slightly more wiring space than is absolutely essential and, for that reason, first costs are apt to be comparatively higher than other means of distribution. However, the practical advantages, long-range economic considerations and the conveniences resulting from the installation are readily apparent. Mechanical protection is excellent, and the use of steel makes possible the continuity of a metallic ground throughout the entire system. Appearance is unexcelled, for raceways can be buried in concrete or floor fill, set flush with wood-block or cement floor coverings, or covered by linoleum or similar surfacing materials. And, after the installation has been established, major economies are possible through minimized re-routing, for service outlets can be established quickly with minimum confusion, noise or dirt.

In brief, therefore, underfloor distribution has advantages for designers, users and owners. Engineers and architects can plan the electrical distribution system without waiting for final partitioning details or exact equipment and furniture layouts. Changes in office arrangement can be effected without requiring major re-routing of services. Except for the possible necessity of pulling in additional wires and reconnecting outlet fittings, the system will serve all normal distribution requirements during the life of the building. And flexibility in use is inherent, for a variety of parts provide for all possible layouts.

SYSTEM COMPONENTS

Components of the system include ducts, junction boxes, box tops to be used in conjunction with different types of flooring, duct supports, end fittings, assembly parts and service fittings.

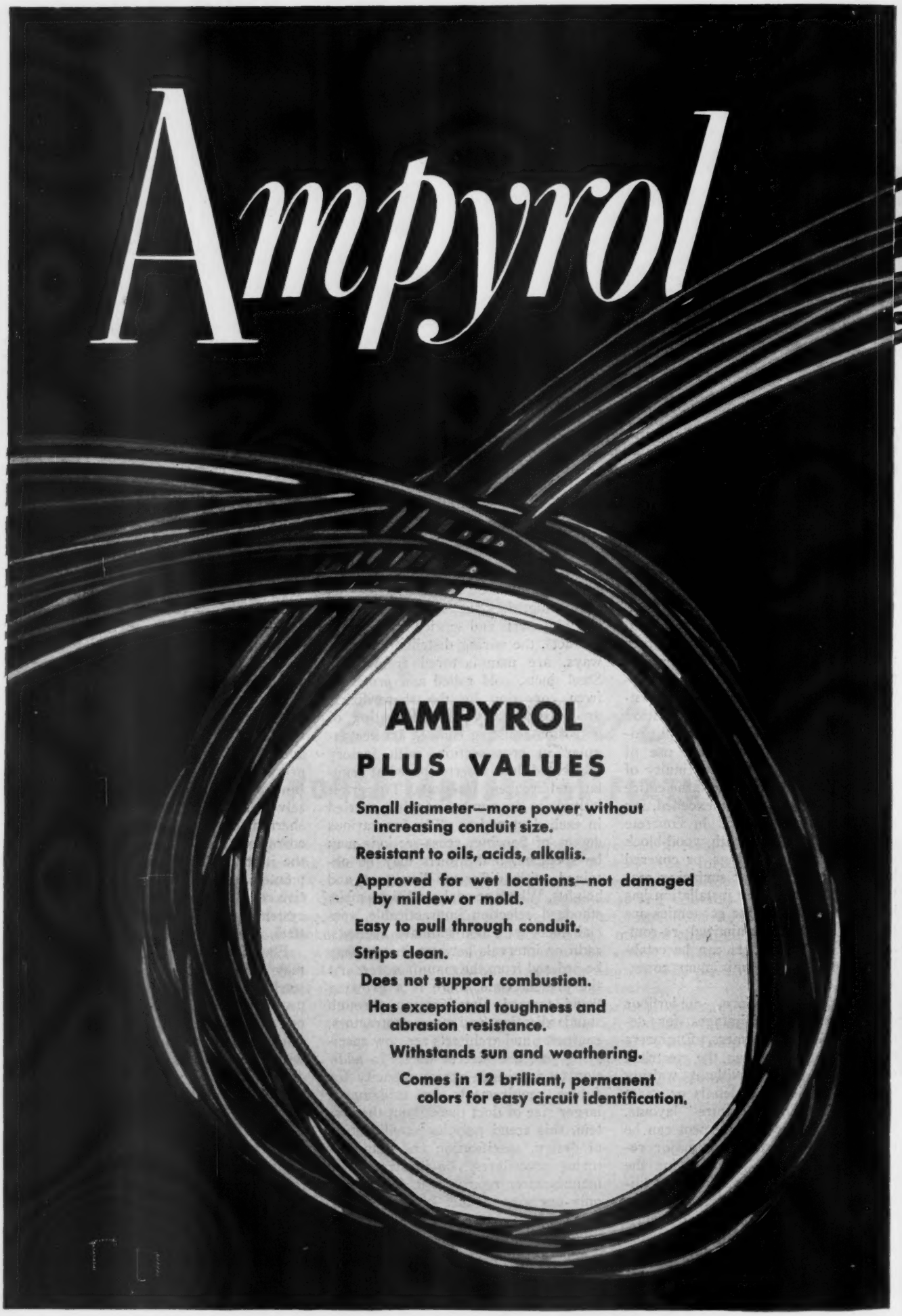
Ducts, the wiring distribution highways, are manufactured from steel. Steel ducts, cold rolled and protected from corrosion by the sherardizing process and an additional coating of corrosion-resisting enamel, are rectangular in cross-section, with factory fabricated floor inserts spaced at regular and frequent intervals. To permit latitude in the number of wires carried in each duct and to allow for various depths of flooring, cross-sections may be specified, and inserts may be obtained with different diameters and heights. Where special conditions make standard selection impracticable, special ducts with non-standard sections, radii or intervals between inserts may be ordered from the manufacturers. At the present time, there is a growing trend toward simplification through standardization, and many contractors, engineers and architects are now specifying just one size of duct. In addition to providing excess capacity for future requirements by utilizing a larger size of duct throughout the system, this trend permits simplification of design, specification and manufacturing procedures. To illustrate: one manufacturer reports that, by making only one size of duct instead of two, catalog items were reduced from 166 to 76 in number; 18 junction boxes to 3 and 24 saddle supports to 8.

At all intersections of raceways, junction boxes are used to permit the crossing of ducts, to connect the system with distribution centers through conduit feeders, and to provide access for installing wires. Boxes are square in plan, with openings on all four sides for one, two or three ducts, and with provisions at the corners for conduit connections. Interior partitions completely isolate the various ducts so that continuous raceways pass through each box in either direction. Boxes and box tops are leveled, raised or lowered by means of adjusting screws or rings, and watertight gasket hand-hole plates prevent moisture from entering these junction points. Like the ducts themselves, the metal junction boxes are sherardized and enameled to prevent corrosion, and ducts are secured into the junction boxes by means of sharp pointed set screws that establish positive metallic grounds between all metal system segments. Besides iron and steel, aluminum boxes are available.

Flat plate tops for junction boxes may be obtained in either brass or steel, or box tops may be selected for use with wooden floors laid on sleepers, marble, terrazzo or other floor finishes. Such tops, recessed and filled with the adjacent floor material, are designed for use where the appearance of a metal top is undesirable.

To support ducts at desired elevations during the process of pouring concrete floor slabs, steel saddles or supports are available with provisions for leveling the raceways and adjusting the duct heights. After supports have been adjusted, ducts are held in rigid position by means of locking screws.

In assembling underfloor distribution systems, assembly parts are avail-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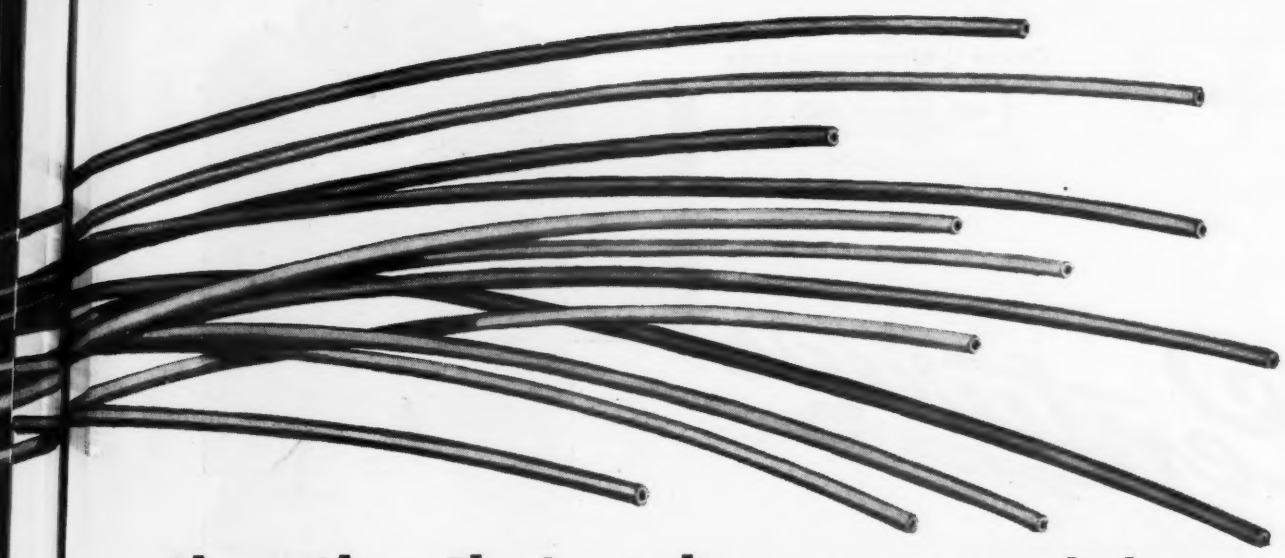

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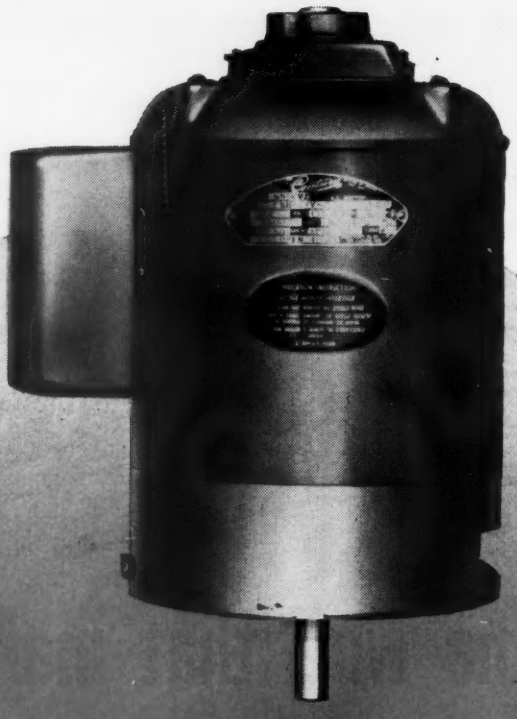

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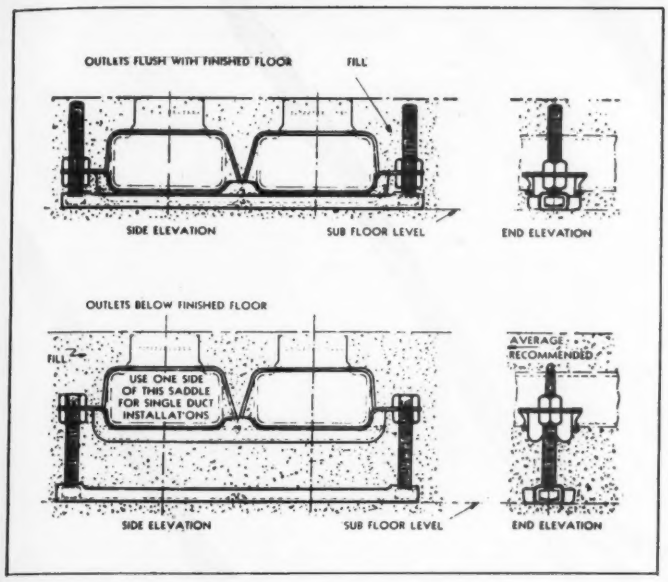
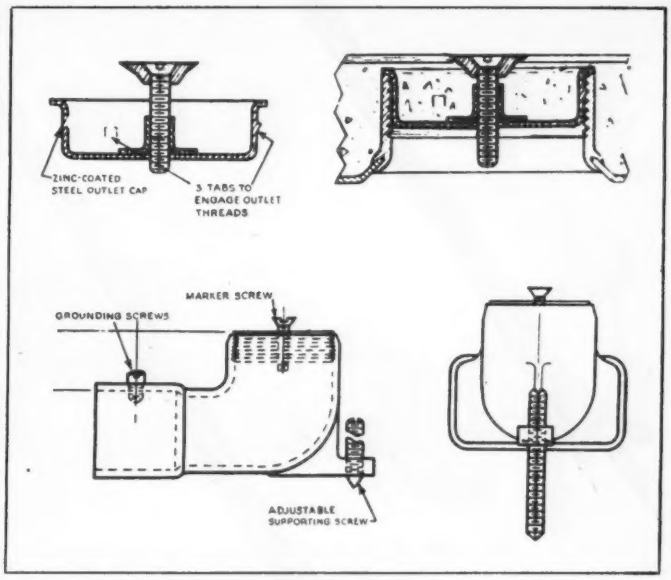


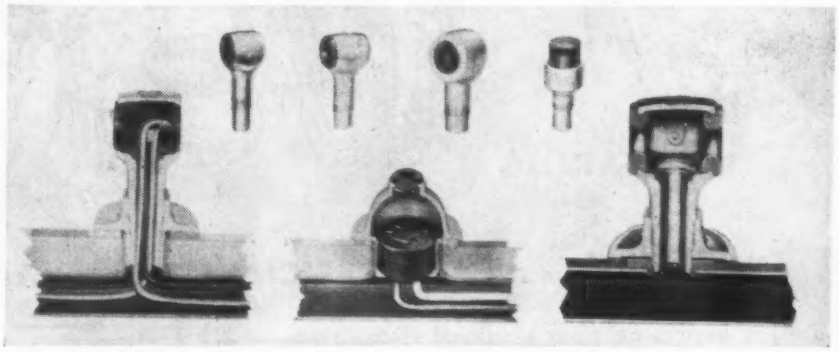
DUCT SADDLES, adjustable for height, hold underfloor wiring channels securely while concrete slabs are being poured.



MARKER SCREWS, set into outlet caps and duct end outlets, are adjusted flush with finished floors, indicating extremities and center lines of channels.

able, such as blank washers for closing unused duct openings, adapters to permit the connection of feeders or branch conduits to local utilization points, couplings to connect duct sections together, vertical elbows for extending ducts to wall cabinets, curved elbows for obtaining changes in raceway direction, cross-under sections to permit the crossing of raceways without the use of junction boxes, and insert extensions to provide added depth between ducts and finished floor surfaces. When inserts, other than those included on the factory-assembled duct-runs, are desired at intermediate duct points, special insert holes may be cut with rotary saws, and the extra inserts can then be positioned and crimped into place with tools designed for that purpose.

Service fittings for a variety of purposes also may be obtained and, as they are obtainable in sturdy brass, they combine utility with a pleasing appearance. Using split sleeves and/or threaded connections, these fittings are secured in place and positively grounded when they are screwed into position.



SERVICE FITTINGS for standard and flush-type duct systems have split sleeves and/or threaded connections, securing and grounding parts simultaneously. Fittings can be selected for specific purposes and locations.

WIDE APPLICATION

In new construction, where structural conditions permit, top surfaces of raceways are usually located from $\frac{3}{4}$- to $1\frac{1}{4}$-inches beneath the level of the finished concrete floor, for a greater depth than this is apt to create difficulties in wire pulling or fishing, and lesser depths often result in the development of cracks in the finished floor surfacing.

After underfloor ducts have been installed, two methods are used to relocate the raceways and outlets beneath the concrete, wood or marble flooring. The first is with the use of marker screws, the heads of which are set flush with the finished flooring and indicate the center line or the extremities of each run. The second method is with the use of insert locators.

Locators can be obtained for use with 110-volt a-c or d-c, or they may be self contained with dry cells supplying the necessary current. These devices operate on the principle of electro-magnetic induction and, as the finder approaches a metal duct or insert, an audible signal can be heard in the earphones worn by the operator. With sound levels varying in direct proportion to the proximity of metal masses, locating ducts and inserts is both positive and rapid. And accuracy is such that exact center lines can be determined through floor coverings up to 3 inches. By using these locators, the expense of marker screws or escutcheons is unnecessary, and reference to blue prints and building records is also eliminated. In use, the finders are placed over the estimated location of a raceway and are then moved across the floor surface until the tone intensity indicates that the duct has been found. The finder is then moved along the line of the duct until the sound in the earphones again increases, indicating the exact location of an insert. This method eliminates the possibility of useless cutting and patching, and also results in a neater, unmarked floor. Of course, since the locators indicate metal masses, those devices are useful only when floor coverings are non-metallic, such as for terrazzo, wood, marble, linoleum, rubber tile, cork, concrete or carpeting.

The duct systems discussed so far, with raised pre-fabricated floor inserts to receive service connections, can be advantageously incorporated in the

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For besides holding its excellent insulating properties after long immersion in water, VINYLITE Plastic insulation is highly resistant to greases, oils, ammonia, oxygen, alkalies, and most strong acids. Flexible and strong even at low temperatures, it permits smaller outside diameters for the same conductor sizes, allowing more conductors, or larger ones, in a given space.

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Data Courtesy Crescent Insulated Wire & Cable Co., Trenton, N. J.

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S.I.C.* at 23 deg. C.

Days Immersion*	Sample #1	Sample #2	Sample #3
Orig.	4.65	5.26	5.45
14	4.85	5.33	5.67
102	4,98	5.32	5.64
255	4.75	5.12	5.49
549	5.58	5.90	6.44
750	5.70	5.96	6.62
1000	5.44	5.56	6.04
1250	5.84	5.74	6.38
1568	5.59	5.61	6.42
2550	5.75	5.33	6.23

*In fresh water tanks at constant temperature.

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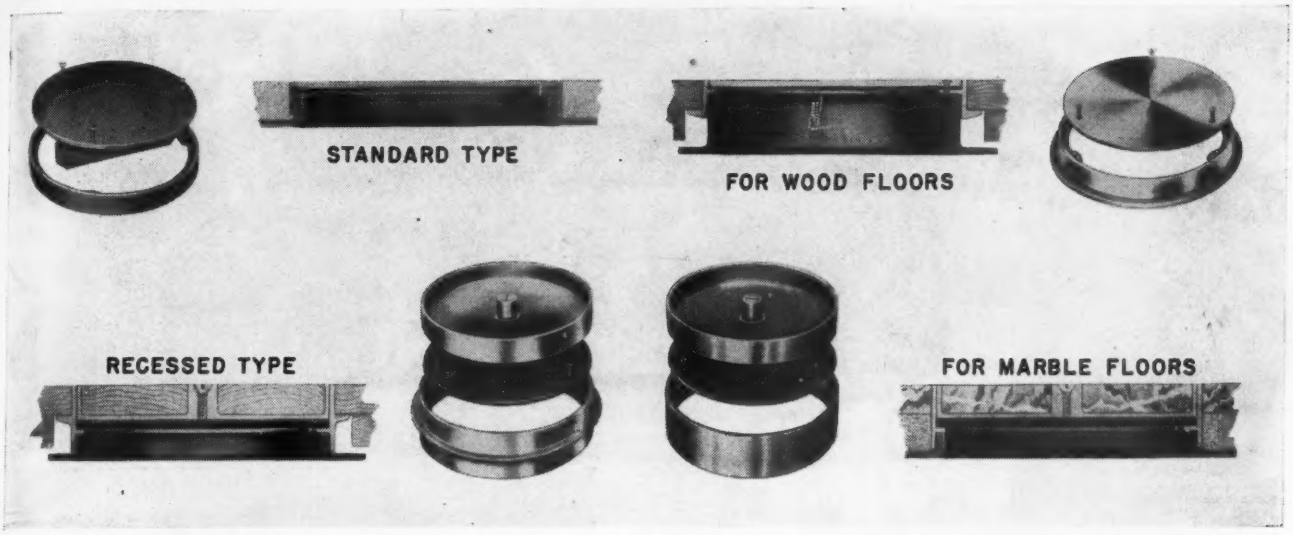
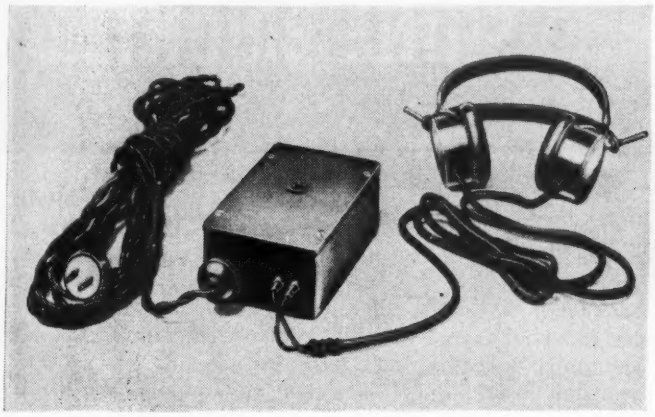
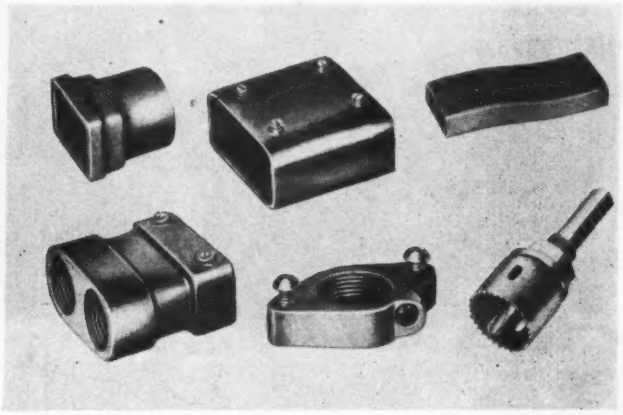


***JUNCTION TOPS** can be flat or recessed to receive a floor-matching insert of wood, terrazzo or marble filler. Adjustable rings, with or without flanges, are designed for use with wood, masonry or composition surfaces.*



***INSERT FINDER**, operating on principle of electro-magnetic induction, eliminates necessity for marker screws. Hidden ducts are detected by audible buzz in earphones. Sound fluctuates in accordance with duct proximity.*



***ASSEMBLY PARTS** include adapters for duct-conduit and conduit-box connections, couplings, offsets, hole cutters and other accessories designed to further flexibility of underfloor systems.*

flooring of all new office buildings, regardless of whether floors utilize bar joist or metal form construction, cellular steel framework or concrete slabs. But flush floor ducts are likewise available for renovating existing office space. Flush systems are installed by cutting shallow channels in the existing flooring, grouting ducts into these trenches so that upper surfaces are level, and recovering the floor with linoleum, rubber tile, carpeting or other similar material. Since the ducts are level with the floor surfaces and since no raised pre-fabricated inserts are incorporated for attaching service fittings, fittings are inserted directly into duct openings and attachments are established through ferrules designed to accommodate special supports and service fittings. However, if floors are at all unstable, preference should definitely be for a standard (rather than flush) system.

A wide variety of assembly parts can be obtained for use with such a flush system, the parts including junction boxes, blank washers for closing unused openings in the boxes, washers tapped for various sized conduits to permit the installation of branch runs and connections between boxes and distribution centers, plugs for closing the ends of ducts, vertical duct elbows for bringing wiring channels from floors to walls, duct couplings and supports.

Another underfloor distribution means, which may be used alone or in conjunction with pattern underfloor duct systems, consists of special floor boxes served by sub-floor conduit runs. When outlet requirements are few, this type of distribution is quite satisfactory and, when an occasional outlet is desired at a position not in an area served by geometrically-positioned duct runs, a branch run can be connected to any of the standard duct junction boxes. These special floor boxes are moisture and waterproofed by gaskets, protected against corrosion by zinc coatings and brass cover plates, and leveled or raised to meet floor finishes by means of adjusting screws.

This system can also be equipped with a variety of service fittings.

Therefore, by judiciously selecting underfloor duct, flush systems or special floor boxes, and combining these wiring raceways with the proper accessories and fittings, the advantages of floor-borne distribution can be obtained for either old or new office structures. Since modern business demands both flexibility for electrical distribution and unlimited outlets for power, underfloor systems are rapidly becoming not only a convenience but a positive necessity.

Don't Miss the NEW
READER SERVICE page 161

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In the News

Eastern Section IAEI Annual Meeting

The Eastern Section of the International Association of Electrical Inspectors held its 1949 Annual Meeting early this year. Meeting at the Hotel Statler in New England's historic Boston, for the first time since 1935, more than 250 members and 90 wives and guests registered for this three day affair. It was one of the Eastern Section's best attended meetings, notwithstanding its mid-summer date of August 11-13, the last three days of what turned out to be one of the hottest weeks on record in the East's Atlantic Coast area.

This meeting was a double-barreled affair. It was not only the first of the Association's 1949 round of Annual Meetings, but was the 25th, or Silver Anniversary meeting of the Eastern Section. This may account in some measure for its excellent attendance. Other 1949 annual IAEI Section meetings are as follows: Western Section—St. Louis, Mo., Hotel Statler, Sept. 26, 27, 28; Northwestern Section—Butte, Mont., Hotel Finlan, Oct. 3, 4, 5; Southwestern Section—San Diego, Calif., Hotel San Diego, Oct. 10, 11, 12; and Southern Section—Houston, Texas, Hotel Shamrock, Oct. 17, 18, and 19.

The three day program opened with an address by Eastern Section President B. A. McDonald, Electrical Supt., New York Insurance Rating Organization, Rochester, N. Y., and was followed by the Presidential Address of Charles A. Ward, International President, and Chief Electrical Inspector for the City of Paterson, N. J. These talks were followed by others on various technical subjects, including Common Grounding, Circuit Protection, Radiant Electrical Heating—Types and Wiring Problems, Steel Raceways, Circuit-Breakers, and Pressure Switches. Each day's program was begun by an informal Code chat, and a period was reserved during both morning and afternoon sessions for Code discussions on topics not assigned. These were participated in widely by inspectors, electrical contractors, manufacturers and others, and proved to be a most interesting part of the program.

The conference was officially opened by J. D. Lynett, Chairman, Annual Meeting Committee, and past president of IAEI and the Eastern Section. He complimented the Program Committee for the excellent program which had been prepared, especially for allowing considerable time in each session for Code discussions in which all present were invited and urged to take part.

Section President B. A. McDonald then opened the business meeting for roll call and for reports from the Secretary and the Treasurer. Secretary F. N. M. Squires reported that net membership had increased during the year, and that 32 new active members and 265 new associate members had been added. Treasurer A. W. Hopkins, who was commended for his stewardship as Treasurer for 20 years, reported favorably on the Section's financial affairs.

After conclusion of other business, President McDonald read a message from Past-President H. H. Daniels, Washington, D. C., expressing his regrets on being unable to attend this meeting on account of illness. McDonald then announced that the Section Executive Committee had voted an Honorary Membership in IAEI for Mr. Daniels, and that he was being so advised.

As President of the Eastern Section, B. A. McDonald then addressed the group. He reviewed membership growth and electrical progress over the past 25 years, reminiscing in behalf of the Section's Silver Anniversary celebration which was combined with this annual meeting.

"Twenty years ago there were three Chapters in the Eastern Section with a total of 1041 members", Mr. McDonald said, and continued "Today we have nine chapters, with a total membership of approximately 2000, representing an increase of nearly 100 percent in 20 years". Comparing this with the membership growth in the Western Section over the same period, which climbed from 599 twenty years ago to 2135 in 1948, or about 250 percent, and pointing out that some States within the Eastern Section now have less than one member per 100,000 population where there should be from ten to fifteen members per 100,000 population, he appealed to all members to assume initiative and to promote membership wherever possible.

Commenting on electrical progress, Mr. McDonald said "When we reflect and recall all that has happened in our electrical wiring industry during the past 25 years—new applications, new methods, new materials and devices—we have a right to be amazed and also justly proud to be a cog in an industry which has made such advances in so

Eastern Section IAEI members serving on the 1949 Annual Convention Committee and contributing to the success of this 25th Anniversary Convention, held in Boston during August included (l. to r.): C. L. Devoe, Boston Treasurer, Boston; Leo P. Landry, Boston Vice Chairman and Supt. of Wire Dept., Watertown, Mass.; Bernard B. Whelan, Chairman of the 25th Anniversary Convention Committee and Supt., Wire Division, City of Boston; John J. Reddington, electrical contractor and Chairman Finance Committee, Boston; and O. H. Zamore, Secretary, Paul Revere Chapter and Inspector, Boston Edison Co., Boston.

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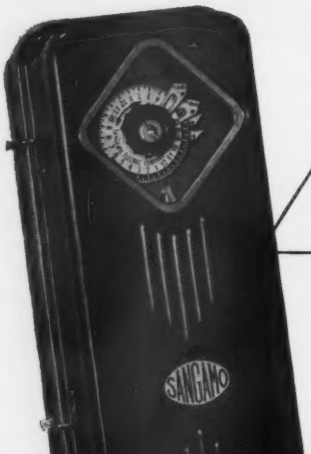
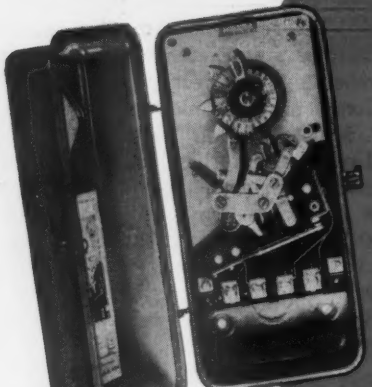
Type L (Synchronous)
can be equipped with various control features. Also available in Type W (Synchronous-carryover).

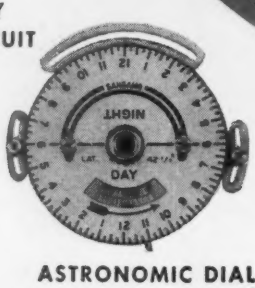


Heavy-Duty Time Switches

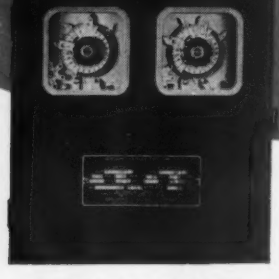
for practically any conceivable time switch application



TYPE LY
TWO-CIRCUIT



ASTRONOMIC DIAL



TYPE LD DUPLEX

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Synchronous • Synchronous-Carryover • Electrically Wound

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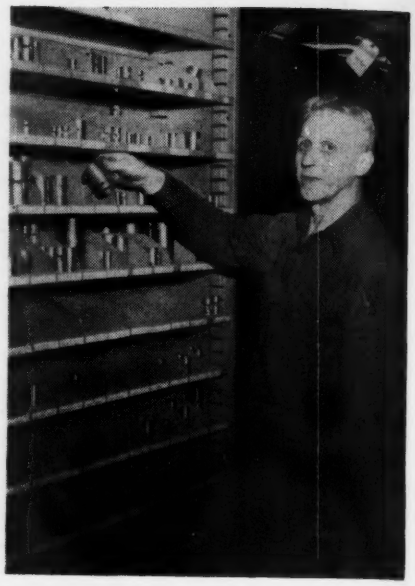

Shop Superintendent J. C. Snyder, in charge of the motor repair division of the Electric Construction and Machinery Company, Kalamazoo, Mich., demonstrates accessibility of open bin storage system for sleeve bearing stock.

short a time". He then enumerated some of these applications, materials, and devices, including infrared drying, inductive heating, electrostatic air-cleaning, the electric fence, electrical radiant heating, new conductor insulations, radar, recessed lighting fixtures, garage door openers, electrical metallic tubing—these and many more —which have been introduced to the electrical wiring industry during the 25 years' existence of IAEI's Eastern Section.

The inspector and IAEI have kept pace with electrical progress, Mr. McDonald pointed out, through the Association's publications, through its meetings, and through the cooperation of industry speakers from all branches of the industry. Commenting further on publications, he said "The first News Bulletin (IAEI) was published 20 years ago last March. Anyone who has retained his copies has undoubtedly the finest history on the progress of the electrical wiring industry available. The Bulletin has kept inspectors up-to-date with the new applications of electricity, it has promoted uniformity in Code matters, it has made inspectors conscious of the electrical fire and injury hazard".

Referring to the Association and the part it has played in electrical progress, Mr. McDonald stated "We will continue to be important (to this progress) if we do not lose sight of the main purpose for our existence, the practical safeguarding of persons and properties from the hazards of electricity created by inferior materials, poor workmanship or faulty installation".

International President Charles A. Ward next addressed the group on a number of topics which are of interest to all IAEI members. The first topic related to the seven "Objects of Association" (Article II—Articles of Association), which "are the light by which we are guided to a more complete understanding of the problems affecting the individual inspector and inspectors collectively, and should also act as a guide for the electrical industry in seeking an understanding of the inspectors' problems, he said, and "should act as a means for improving the standards of the National Electrical Code . . . so it becomes a code which can be accepted nationally as a minimum standard acceptable to the greatest possible extent in all inspection jurisdiction, be they national, state, municipal or insurance".

Mr. Ward then told the group that "In order to fully comply with the 'objects of association' sufficient revenue must be obtained to provide the necessary funds in a yearly budget," and outlined in considerable detail some of the problems involved in "correcting the financial instability of IAEI," which the Executive Council has had under discussion at various times during recent years. He then reported on a meeting of the Advisory Committee to the President and Secretary-Treasurer, which was held in Chicago June 26-27, 1948, at the special request of then-President Volheye, which was also attended by the finance committee consisting of the five section secretaries who were also requested to attend. The many problems which at that time confronted the President and newly-appointed Secretary-Treasurer, Charles L. Smith, were discussed at length. "Invariably the solution of the various items presented reverted back to the main point—do we have the financial stability to carry out the recommendation?", Mr. Ward reported.

Commenting further, he said "In the vital matter of finding ways and means for raising additional revenue it was decided to explore the field further for new sources of revenue. The other matters being contingent upon the outcome as to how sufficient revenue could be raised, no final decision was arrived at and no final action was taken".

Following the favorable vote of the various sections at the 1948 annual meetings to expand the Advisory Committee to include the Finance Committee and to hold a yearly meeting of the expanded Committee, a meeting of this Committee was called and held during the annual meeting of the National Fire Protection Association at San Francisco, California, the week of May 15, 1949. Reporting on this meeting, President Ward said "A proposed

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Single Pole, Single Throw, Rated 15 Amps.
Available in Ivory or Brown
Precise Miniature Switches
Compact · Economical · Attractive
Can be wall or switch-box mounted
Type SJ (Plug-in)
Rated 10 Amps. or ¼ hp at 120 volts.
INTERVAL TIMERS
Ideal for attic fans and unit heaters. Adjustable from 15 minutes to 12 hours.
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Write for information—it's to your advantage.
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1. Extra length pressure bar extending beyond nut, keeps threads firmly meshed, prevents stripping.
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5. Nut of high strength Duronze.
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means for raising sufficient revenue to provide for current expenses and for the proposed expansion of our office staff was favorably received at this meeting. This proposal was referred to the Committee on special types of memberships for municipalities and cities. The report of this Committee is to be presented to the five Section meetings of the Executive Council for adoption or rejection. I sincerely hope that the recommendation will be favorably acted upon."

Another subject covered by President Ward was that of a closer relationship of the five Sections of IAEI and of the membership as a whole. "Definite provision should be made for regular, frequent meetings (of the Executive Council)", President Ward said, pointing out that this recommendation is in keeping with the present By-Laws, Section 6, but that the proposal cannot be put into effect until such time as sufficient funds are made available to provide for such meetings.

Continuing on this subject, President Ward also said "Another thought on the subject of more complete understanding between the members would be the possibility of holding joint meetings between several sections at stated intervals, and we should also explore the possibility of holding an occasional joint meeting of all the sections. I would suggest and would like to see this arranged for every five to ten years".

President Ward next reviewed the history of electrical codes which led eventually to the adoption of the National Electric Code by the code-makers of four "national" codes which by that time (1895) had acquired the most widespread prestige in the United States. This National Electrical Code ever since has been the principal source which local code-making authorities have used as a general basis for their own local codes.

"A very great degree of uniformity among local codes was promoted from about the turn of the century by the formation of sectional associations of electrical inspectors", President Ward said. "Some mistakes were made but no commercial considerations were allowed to sway these inspector associations away from their main motive —safety so far as reasonable". Out of these local inspector associations finally evolved the formation of an international association, the present IAEI.

Concluding, President Ward said "A very happy change in national code-making, by which voting power directed by commercial associations will not apparently control the code-makers even temporarily, is now being observed and aided by inspectors, through this International Association of Electrical Inspectors. The better

the proposed National Electrical Code editions become, the greater confidence becomes among inspectors in this new code-making process and the less, naturally, will be the unacceptable provisions, the less the additions, which careful inspectors will still find necessary in their own home rule codes".

Charles L. Smith, IAEI Secretary-Treasurer, gave a report on national activities. He reviewed the accomplishments of the Association during the past year, explained some of the current activities and objectives, and told about plans for the future.

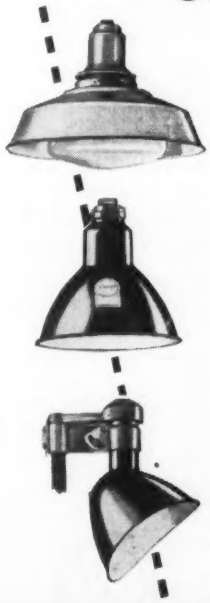
A. H. Schrimer, Chairman Panel No. 5, Electrical Section, N.F.P.A., presented the first technical paper which was on the subject of "The Importance of Common Grounding at Customers' Premises". A review of the many articles in the technical press on this subject indicates a lack of understanding, he explained, and then discussed the need for grounding, giving many examples of existing practices and hazards. He also discussed the relationship of lightning rod grounds and conduit system and open wiring grounds. Considerable discussion of Article 250—Grounding, and Section 2586—Use of Lightning Rods then followed.

"What the IAEI Means to a Manufacturer" was the subject of a talk by Joseph J. Siddall, Manager, H. H. Robertson Company. He told of some of the problems which have been found by his company as one of the electrical equipment manufacturing group, by the electrical industry and by inspection groups. One major problem is the existence of over 2000 building codes in the United States, he said, and when his company became a cooperating member of IAEI there were over 25 separate groups involved in the National Electrical Code, which has since grown to 42. "Don't sell the inspector short" was his advice to the electrical equipment manufacturers, and then referred to the partnership relation which exists between inspectors and cooperating members, pointing out that "without materials there would be nothing to inspect".

J. L. Wagoner, Westinghouse Electric Corporation engineer, talked on "Hazards of Inadequacy", effectively using an adequite wiring and circuit protection demonstrator. "It is a fact that a great majority of the homes today are inadequately wired", he said. Pointing out that selling adequate wiring to these homes is not an easy job, he described the demonstration which he used with his discussion. The demonstrator has been developed in an effort to provide a simple and easy-to-visualize method of what adequacy and inadequacy in wiring means to the home owner.

The Importance of

GOOD LIGHTING



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FOR LONG ELECTRICAL LIFE

Give electrical apparatus the benefit of Tuffernell 4-Way Protection:

1. High dielectric strength
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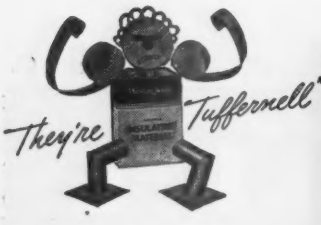
These qualities are characteristic of the new Tuffernell Thermo-setting Varnishes. For example, Tuffernell B-161 is already a favorite with many users. It provides the *extra* protection needed for dependable operation under conditions where ordinary varnishes break down.

A good illustration is the growing use of Tuffernell for mine electrical equipment. Below ground, and above, the service is unusually severe. Many progressive mine operators now use Tuffernell exclusively when rebuilding apparatus.

Such proof of performance is assurance of dependability for your equipment, too. For data on the complete Tuffernell line, call your nearby Westinghouse office. Ask for Bulletins 65-120 and 65-130. Or write Westinghouse Electric Corporation, Dept. 19, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-06433



Westinghouse

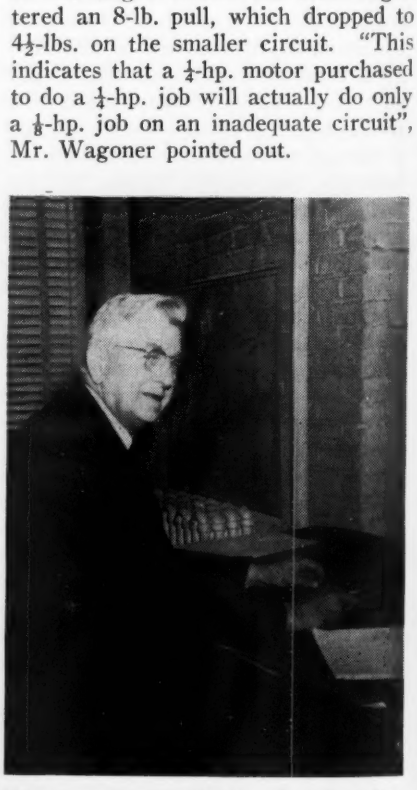
TUFFERNELL INSULATING VARNISHES

—for every electrical need

The demonstrator uses two 100-foot circuits, one of No. 18 wire and one of No. 12 wire. Wagoner first connected a 15-watt incandescent lamp in each circuit and pointed out that there was no appreciable difference in brightness of the lamps, since only about one-tenth ampere was involved. He then connected a heater element in each circuit, demonstrating the drop in brightness of the 15-watt lamp in the No. 18 circuit while the 15-watt lamp in the No. 12 circuit continued to burn with the same brilliance. He then used a voltmeter to show incoming voltage, and voltage on the load side on each circuit, showing visually how inadequate wiring affects voltage at the point of use when normal appliance loads are used.

Standard heating elements were next connected in each circuit. The element glowed brilliantly on the No. 12 circuit, but was barely luminous on the No. 18 circuit. "Energy loss is considerable in inadequate wiring", Wagoner pointed out, "and much more time is required for cooking, ironing, etc. with poor wiring. Due to the time element involved, savings in kilowatt hours with adequate wiring will soon pay for the better wiring system."

Another demonstration was the attaching of a small motor to a spring scale. When the motor was connected to the larger circuit the scale registered an 8-lb. pull, which dropped to 4½-lbs. on the smaller circuit. "This indicates that a ¼-hp. motor purchased to do a ¼-hp. job will actually do only a ⅛-hp. job on an inadequate circuit", Mr. Wagoner pointed out.



Engineer H. C. Rhode also handles electrical estimating for the Central Electric Motor and Construction Co., Battle Creek, Michigan, a subsidiary of the Harlan Electric Company of Detroit.

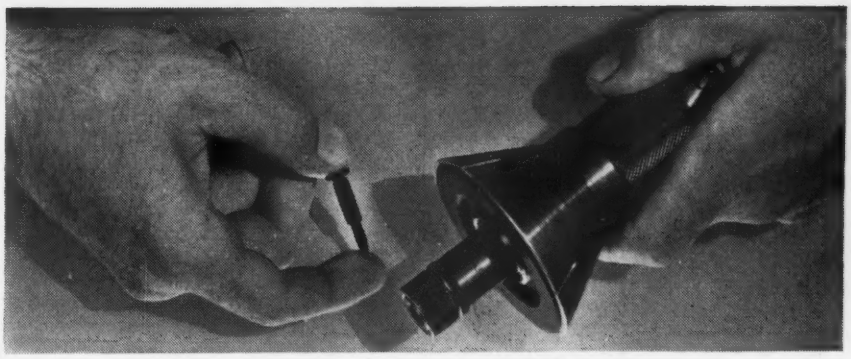
J. L. Crum, electrical contractor of Pennbrook, Penna. (left) discusses Planned Lighting activities in his community with Leo Fetterman, Commercial Representative of Pennsylvania Power and Light Company, Harrisburg, Penna., between sessions at the East Central Regional Conference of the Illuminating Engineering Society in Harrisburg June 6th and 7th.

Using water pipes as an analogy Mr. Wagoner pointed out that when a water pipe is overloaded—it bursts; while an electrical conductor which is overloaded—overheats and becomes a fire hazard.

The demonstration was next used to show overload protection. The No. 18 wire was replaced by a short piece of bare copper wire, over which was placed a piece of paper. A 15-watt lamp was connected to the circuit, and nothing happened except that the lamp lighted normally. Next a heater element was placed in the circuit, which caused the fuse to blow. Since a tamper-resisting fuse had been used, an oversize fuse could not be inserted. Next an old style Edison base plug fuse was used. When the current was turned on, using the same heater element, the fuse blew again. This fuse was then replaced with a 30-amp. fuse (or bridged with a penny), and the circuit again connected. This time the bare wire heated up, the piece of paper smoldered, and finally burst into flame as the bare copper wire was overloaded and overheated.

The fuse block was next replaced with a tamper-resisting circuit-breaker to demonstrate overload protection. With overload, the circuit-breaker tripped. The circuit-breaker handle was held manually, and it still tripped with overload.

This simple, elementary demonstration gave visual proof of how safety and economy are provided by adequate wiring.



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A $70 investment in a RAMSET TOOL saved this contractor (name on request) $2,122 *on just one job.* Cost of setting 7,118 fasteners by drilling and tapping would have been $4,742 (plus material). With the RAMSET SYSTEM, the total cost for material and labor was $2,620—saving $2,122 or 44.7%. All for a $70 investment!

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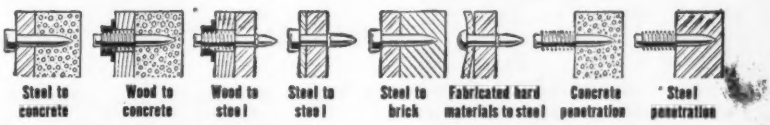
No matter how large or how small your fastening jobs, you do them better, quicker, cheaper the RAMSET way. The light, portable tool takes only 30 seconds to load. No electric or air lines—it's self-powered. Press it against the work and RAM—the job is done. So simple and easy that we can teach any good workman, in an hour, to "RAMSET" jobs like these:



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Ask for 15-minute demonstration of RAMSET SYSTEM. We'll show you how you can do your work faster, better and at amazingly lower cost. No obligation—just mail the coupon for details. *Stemco Corporation, Cleveland 16, Ohio.*

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Please send details and arrange for demonstration of RAMSET FASTENING SYSTEM and how it will save time and cut our costs.

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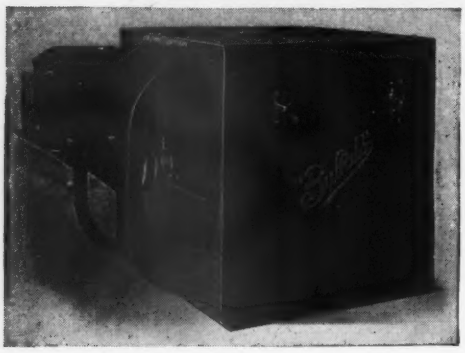

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PANEL BREEZO FANS BELTED VENT SETS BELT-AIR FANS
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The next subject covered was "Radiant Electric Heating—Types and Wiring Problems", which was presented by D. B. Anderson, electrical engineer, Underwriters' Laboratories, Inc. Mr. Anderson first explained the three types of heating—convection, conduction and radiation. He then gave considerable history on heating by electrical and other radiation, which has been used to a limited extent in Europe for many years. He described the different types of electrical heating and materials which have been used in this country, explaining the wiring methods used for each.

Walter O. Zervas, research engineer with American Iron and Steel Institute, discussed "Steel Raceways". Research is being carried on constantly with the electrical industry on the use of steel and in an effort to make steel products work better, he explained. Efforts on standardization for zinc coated and enameled rigid conduit and electrical metallic tubing are under way, he said.

Walter H. Bodle, sales promotion manager, Square D Company discussed "Over-Current Protection", using an ingenious demonstration to show visually some of the things which happen in electrical circuits and how circuit protection devices protect wires and insulation, including how accurately a circuit-breaker does its job.

Mr. Bodle reviewed the history of over-current protection, pointing out that metals which melt at lower temperatures than copper were first used, and that the first circuit-breaker was brought on the market in 1928. The demonstration equipment was used to show the temperature rise in wire under various loading conditions, and the time element involved. Various over-current protection devices were used in the experiment and the time element measured to one-one hundredth of a second for each, for purposes of comparison.

The final technical paper was on "Pressure Switches as Service Switches", and was presented by Eustace C. Soares, Industrial Engineering Services. The principles of the pressure switch were demonstrated with a large model, showing the small arc through which the arm moves to exert very high pressure. Various technical data were also presented with charts.

The first thing to do is to establish optimum requirements and then to select that equipment which will most adequately meet those requirements, Mr. Soares explained. He also pointed out that it is temperature rise, and not current-carrying capacity, which determines the electrical loading.

During the closing session J. D.

Construction Supt. C. G. Fox, Barker-Fowler Electric Co., Lansing, Mich., points with pride to cable salvage drum he designed to pull lead-covered cables from existing conduits and ducts.

Lynett recommended that the incoming Eastern Section President appoint a Chairman of the Fire and Accident Reporting Committee, to report fires due to faulty electrical work and deaths due to electrical shock. He also recommended that this Chairman be asked to appoint a Reporter or Chairman in each Chapter, whose job it would be to obtain more reports and information on these hazards and deaths. He also asked that President Ward carry this suggestion to other Sections, and that a real effort be made to obtain accurate data on electrical fires and accidents throughout the nation, including causes and pertinent details. President Ward expressed complete agreement and further stressed the importance of such reports.

The Nominating Committee which had been appointed by President McDonald during the first business session of the meeting presented its slate of officers for the coming year during the closing session. Election by voting was carried out, and the new officers were then installed by President Ward. Those elected were: B. B. Whelan, President; B. F. Greene, 1st Vice President; L. J. Wiley, 2nd Vice President; A. W. Hopkins, Treasurer; F. N. M. Squires, Secretary. Elected to the Executive Council were Frank Stetka, Chief Electrical Inspector, District of Columbia, Washington, D. C., and Peter J. Hicks, Jr., Chief Electrical Inspector, Providence, R. I.

Other highlights of the Eastern Section Annual Meeting included an evening of entertainment consisting of comedy acts and musical numbers, a Silver Anniversary dinner-dance, and conducted tours for the ladies.

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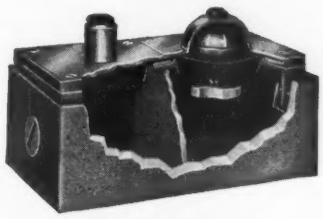
"Latrobe" Floor Boxes and Wiring Specialties are designed straight to the purpose. They are stripped of showiness, fanciness, excess parts. No wandering around in circles to install "Latrobe" Products . . . simple and quick. No waste power or needless wear in service . . . but straight to the job, accurately and dependably.



No. 252-R "Latrobe" Two Gang Box

Watertight and adjustable with No. 208 Receptacle in one section. Compact and efficient. One Cover Plate has ½" flush brass plug; other, 2".

No. 110 "Latrobe" Watertight Box

The neat, unique design of the No. 110 Box allows it to be installed in record time. Its simplicity assures trouble-free performance. Cover Plate is 3½" diam. No. 208 Receptacle.

No. 330 Tom Thumb Utility Outlet

A versatile outlet that is excellent for use in wood floors, mantels, baseboards and other installations free from moisture or mechanical injury. Installed quickly with no harm to finish.

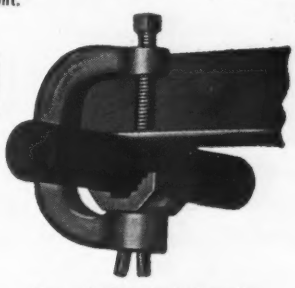
No. 150 Box No. 207 Nozzle

The No. 150 is a soundly constructed Box with 4¼" Cover Plate and large Adjusting Ring No. 215. Compact, economical, efficient.

Sold Only Through Wholesalers.

No. 284 Nozzle with No. 200 Cover Plate

This Duplex Receptacle Nozzle is the most useful and efficient on the market. Is furnished with ½" or ¾" brass pipe extension, and easily installed.



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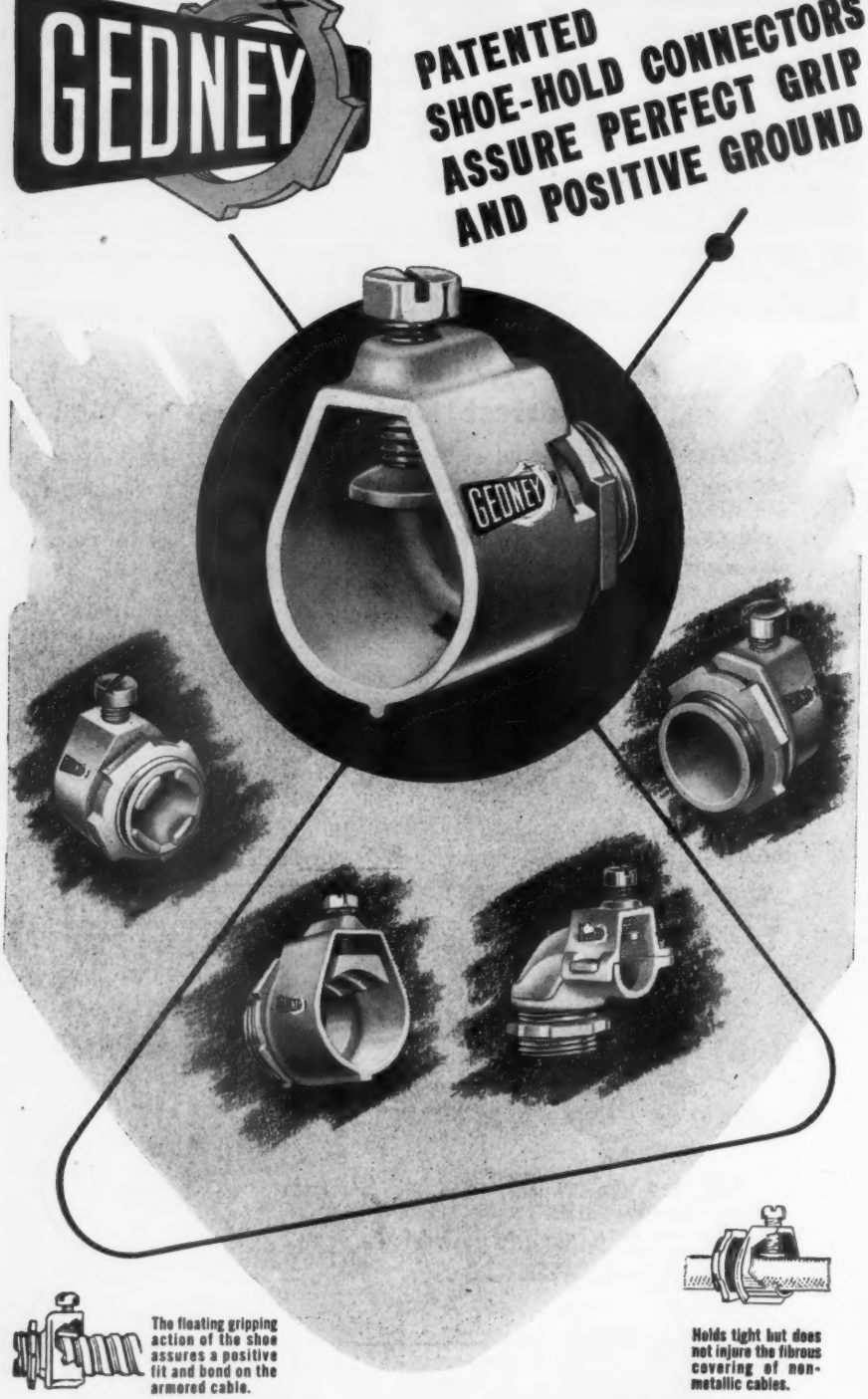
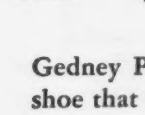




The floating gripping action of the shoe assures a positive fit and bond on the armored cable.

Holds tight but does not injure the fibrous covering of non-metallic cables.

Gedney Patented Shoe-Hold Connectors have a flexible-jointed shoe that makes them conform to the shape of armored cable for positive grip and to clamp non-metallic cable without cutting.

Easier to use, these carefully machined malleable iron fittings are protected by Ged-O-Lite finish that assures long, satisfactory service. Write today for samples and prices. All sizes available.

GEDNEY ELECTRIC CO.

GENERAL OFFICES: RKO BLDG., RADIO CITY, NEW YORK 20, N. Y.

FOUNDRY, FACTORY AND SHIPPING POINT • TERRYVILLE, CONN.

G. E. Announces New Lighting Competition

A new nationwide lighting competition is being sponsored by the Lamp Department of the General Electric Company, Nela Park, Cleveland, in connection with the electrical industry's Planned Lighting Program. Cash awards totalling $21,000 are being offered to individuals responsible for 36 meritorius Planned Lighting installations placed in regular operation during 1949. A total of 192 cash awards are involved.

The awards, described as "an expression of appreciation to those who strive to bring maximum lighting benefits to users of G-E lamps", will be based on reports of lighting installations submitted to the Lamp Department of the General Electric Company and postmarked not later than January 31, 1950.

Awards of $100 each will be made to individuals who have played key roles in planning, selling, supplying and installing the lighting for the 36 outstanding Planned Lighting installations of 1949 in which General Electric lamps are predominantly used. Additional awards of $150 each will go persons submitting reports of winning installations.

There will be 24 awards for commercial and industrial lighting installations, and 12 awards for residential lighting installations. These may be either for the initial lighting of new buildings or the relighting of existing buildings.

The 24 awards for commercial or industrial lighting installations will be divided as follows: eight awards for installations in communities of 5,000 population, or less (including farms); eight awards for installations in communities with 5,000 to 100,000 population; and, eight awards for installations in cities with more than 100,000 population.

Awards will be given for any type of commercial or industrial lighting installation—stores, offices, schools, factories, service stations, restaurants, theatres, etc. However, it was announced that not more than four awards in any of the three population groups, or twelve awards in all, will be given for any one type of installation.

The twelve Planned Home Lighting installations will be divided into three groups of four awards for homes in communities with the same population brackets established for the commercial and industrial lighting awards.

Reports submitted in this competition will be appraised by judges who will select from the reports submitted the installations which they consider

most desirable for the users of lighting.

Judges for the selection of the 24 winning installations in the commercial and industrial lighting classification have been announced as follows: Chairman, Berlon C. Cooper, Eastern editor, *Electrical Construction and Maintenance,* New York City; E. M. Strong, professor, School of Electrical Engineering, Cornell University, Ithaca, N. Y.; and, J. Byers Hays, architect, Conrad, Hays, Simpson and Ruth, Cleveland, Ohio; J. M. Ketch, illuminating engineer, G-E Lamp Department, will serve as technical advisor for these judges.

The twelve winners of residential lighting awards will be selected by the following judges: Chairman, Caroline E. Horn, Electrical Testing Laboratories, Inc., New York City, and chairman, New York Section, Illuminating Engineering Society; Gladys Miller, interior designer, New York City, and member I.E.S. Residence Lighting Committee; Gladys A. Branegan, director, School of Home Economics, College of Agriculture, Ohio State University, Columbus, Ohio; Thomas Smith Kelly, lighting consultant, New York City, and member of I. E. S. Residence Lighting Committee. Eugene W. Commery, head of Residential Lighting Section, G-E Lamp Department will be the technical advisor for the residential lighting awards judges.

"Great enthusiasm for the contest is being shown not only by persons and organizations in the electrical industry, such as electric service companies, lighting equipment wholesalers and their salesmen, and electrical contractors, but also by architects, builders and designers", according to Harold H. Green, of the Lamp Department's Advertising Division, which is sponsoring the competition.

Transformer Specialists Charles J. Covington (left) president, and Rex V. Woodward, chief engineer, Dowzer Electric Machinery Works, Inc., Mt. Vernon, Illinois. Dowzer's transformer repair operations encompass an eight-state area.

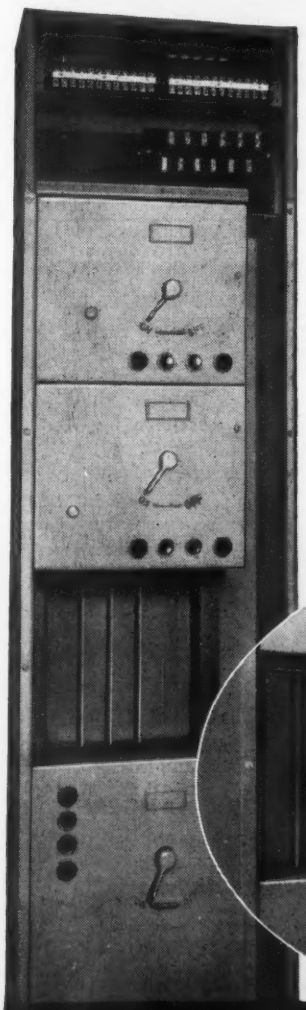
MODERNIZATION *Demands...*

G-E Motor Control Centers

for EASY, LOW-COST INSTALLATION

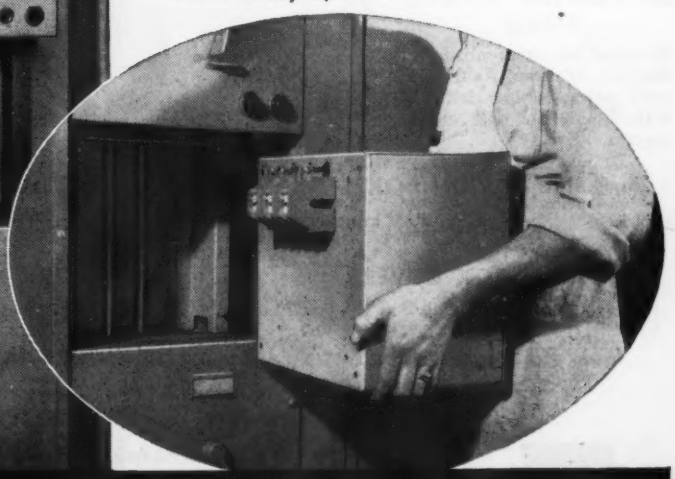
FLEXIBLE ARRANGEMENT

SIMPLIFIED SERVICING



These advantages, plus many more, are yours when you buy economical, G-E motor control centers. Only 12 inches deep, front connected, pre-engineered, can be factory assembled, wired, and tested. Individual sections can hold combinations of two or more sizes of starter units. (NEMA Size 1, 2, 3, and 4 for 1 to 100-hp a-c motors, 440 volts or below). Standard starters in standard vertical sections simplify installation, servicing, and stocking spare parts, yet permit flexible arrangements.

In addition, each unit is "wrapped in steel," has built-in short-circuit and overload protection. Wiring troughs are five inches wide, terminal and incoming bus may be at top or bottom as you prefer—all easily accessible. Wiring time is cut because "clothespin contacts" (below) connect to incoming power in one quick shove. Write now for more details in Bulletin GEA-4979. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*



GENERAL ELECTRIC

IF PRICES MEAN *Anything* TO YOU

—give serious thought to this exceptional Keystone line of electrical equipment. If you want to give your customers "good buys"—if you want to attract more customers—if you want to increase your profits—stock Keystone Electrical Equipment!

Here's a line offered to you at most unusually low prices brought about through many economies effected in our production.

Ask for our dimension catalog and price sheets. Sell your customers the Keystone line and save them money.

UNDERWRITERS LABORATORIES APPROVED

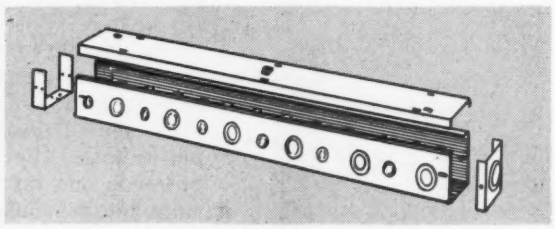
SQUARE WIREWAYS
Flanged Type
with hinged cover

Choice of 4″ x 4″ or 6″ x 6″ sizes in 1′ to 5′ lengths. Hinged cover provides easy access to wiring. With and without knockouts. Black enamel or baked aluminum for coastal areas. All from stock. All same price.

WIREWAY REDUCING BUSHINGS
Plates for reducing wireways from 4″ x 4″ to 6″ x 6″.

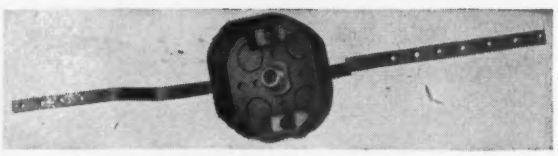
SQUARE WIREWAYS
Flangeless Type
with screw cover
4″ x 4″ & 6″ x 6″

With ½″ to 1½″ knockouts spaced alternately every 3″. End plates have knockouts to accommodate pipe up to 2½″. Also available without knockouts. Black and baked aluminum. Same price. Immediate delivery on small types 1′ to 5′. Any special size made upon request.



OCTAGON CABLE BOXES

Mounted on bars—straight, shallow, or deep. Available with twin knockouts ½″, with Romex or BX cable clamps.



COMBINATION BOXES
Provided with both ½″ and ¾″ knockouts.

CLEAT HANGERS
Provided with 2 slots permitting box to be bolted directly to hanger.

OUTLET BOX COVERS
Two sizes 4″ and 3¼″.

OLD WORK HANGERS
Flat bar type.

All items stocked and ready for immediate delivery

WANTED-SALES REPRESENTATIVES
on few territories still open for experienced go-getters.

KEYSTONE MFG. CO.
23328 Sherwood Road • Center Line (Detroit), Mich.

Proud of 40-year record of service to the electrical industry are: (L to R) L. R. Klose II, secretary-treasurer; and Mrs. Lucille S. Klose, president of L. R. Klose Electric Co., Kalamazoo, Mich., electrical wholesale and motor repair firm. Mrs. Klose has actively managed the firm for 15 years.

Electrical Leagues Plan Conference

President J. Clark Chamberlain has announced that the Fourteenth Annual Conference of the International Association of Electrical Leagues will be held at the Cleveland Hotel, Cleveland, Ohio, from October 12 to 15.

A program committee, consisting of J. G. Waddell, Boston, chairman; S. E. Strunk, Cleveland; J. A. Morrison, Philadelphia, and W. G. Hills, Washington, D. C., held a meeting in Chicago recently to draft the program.

Subjects of current interest to be discussed will include the outlook from an economic point of view, problems and opportunities facing the appliance industry, why women buy home freezers, the lighting survey being conducted in Indianapolis, farm electrification, the legal point of view in association operation, training programs of leagues, promoting ventilation, the impact of television on the electrical industry's business, possibilities and problems in heating homes by electricity, the kitchenizing program, promoting the complete electric laundry, and other activities.

General sessions will be held on Wednesday, Thursday and Friday, October 12, 13 and 14. All sessions will be held at the Cleveland Hotel, with the exception of the one on Friday afternoon, which is scheduled for Nela Park. These general sessions are open to any member of the industry interested in electrical league work.

The IAEL Business Session, at which reports will be presented and directors and officers of the IAEL for 1950 elected, will take place on Saturday morning, October 15.

N.E.W.A. Announces Change of Name

Effective September 1st, by action of the Board of Governors, the name of the National Electrical Wholesalers Association is changed to National Association of Electrical Distributors, according to an announcement by president D. M. Salsbury and managing director Charles G. Pyle.

The indispensable economic functions of the modern distributor of electrical apparatus, supplies and appliances in the opinion of the Board are more appropriately reflected by the new Association name, which will hereafter also be referred to as N.A.E.D.

Of historical interest are the facts that in 1908, at Niagara Falls, Canada, 75 electrical jobbers got together and formed the Electrical Supply Jobbers Association, which was the beginning of the first electrical distribution organization in the United States.

On June 6, 1928, the Electrical Supply Jobbers Association concluded that so many more new and more intricate electrical devices were then being manufactured and distributed throughout the membership, that National Electrical Wholesalers Association should be its new name to denote the growth in stature from a strictly jobbing function to a more economically stable wholesaling service.

Similarly, at Cincinnati in May of this year, the question again arose as to the identification of the electrical wholesaler with regard to the distributive function he performs. With the advent and rapid development of

H. E. Jones, vice-president, Union Electric, Inc., Battle Creek, Mich., electrical contracting firm, does most of the estimating and engineering on their commercial and industrial work; has 12 years of experience in the electrical construction field.

GREENLEE HYDRAULIC BENDER HANDLES WIDE VARIETY OF WORK

Yes, heavy-duty, all-round performance of the GREENLEE Bender expedites jobs, means big time and material savings for W. D. Gale, Inc., Detroit contractors.

Their GREENLEE is pictured above in operation on a recent large installation of new transformers, where it was necessary to make various bends in conduit ranging from 2½" to 3" and 4" sizes.

In reporting on the GREENLEE Bender's performance on this job, Gale workmen said, "It's *heavy-duty*—handles the specific bends and the large diameter conduit necessary to fit the job."

J. A. Schoenith, General Manager of W. D. Gale, Inc., also states that the GREENLEE affords 30% savings in labor hours and 30% savings on manufactured bends.

With a GREENLEE *one man* in but a few minutes makes smooth, precise bends in rigid and *thin-wall* conduit, pipe up to 4½", tubing, bus-bars. It's a compact, portable unit—lets you make bends *right on the job*. Quickly pays for itself. Write today for free Bender Booklet E-201. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1749 Columbia Avenue, Rockford, Illinois, U. S. A.

TOOLS FOR CRAFTSMEN

GREENLEE

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK

Hand Benders • Knockout Tools • Cable Pullers • Electricians' Bits

STANDARD *or* UNDERSIZE

Ask for JOHNSON EM BEARINGS

Catalogue

76 Pages, fully illustrated. Write for a copy TODAY.

o When you need Electric Motor Bearings ask for Johnson Bronze E M. Over 250 individual types, fully machined, ready for immediate use. Cast in a high lead alloy they are guaranteed to deliver the utmost in performance and long bearing life. Remember it's E M in Bearings . . . the highest quality available.

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
The MOST COMPLETE SLEEVE BEARING SERVICE in the WORLD
490 S. MILL STREET NEW CASTLE, PA.

Speeds ELECTRICAL ASSEMBLY

PROTECTION
FLEXIBILITY
SMOOTH BORE
GOOD PUSH-BACK
NO FRAYING

DIEFLEX
VARNISHED TUBING PRODUCTS

Dieflex Varnished Tubings and Saturated Sleevings are completely impregnated and have high dielectric strength. They are used by leading manufacturers and rebuilders from coast to coast. Available in grades, sizes, and colors for every application. Samples on request—write today.

INSULATION
MANUFACTURERS CORPORATION
565 West Washington Boulevard
Chicago 6, Illinois

ELECTRICAL IMC INSULATION

Offices and Distributors in principal cities

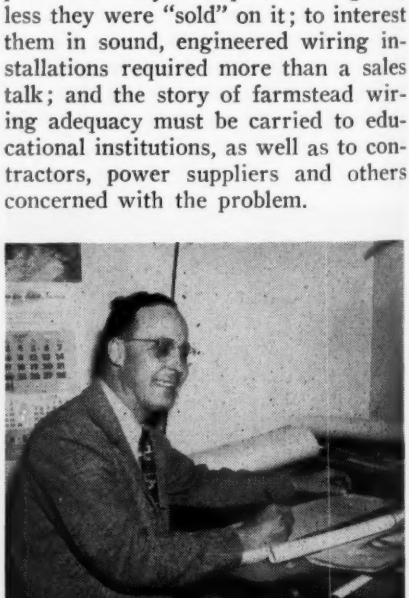
fluorescent lighting, industrial electronic devices, air conditioning, food freezers and television, to name only a few products, "wholesaling" now has been superseded by "distributing" in terms of modern economic services necessarily required by the manufacturer and contractor-dealer.

The headquarters offices of the National Association of Electrical Distributors will remain at 500 Fifth Avenue, New York 18, New York.

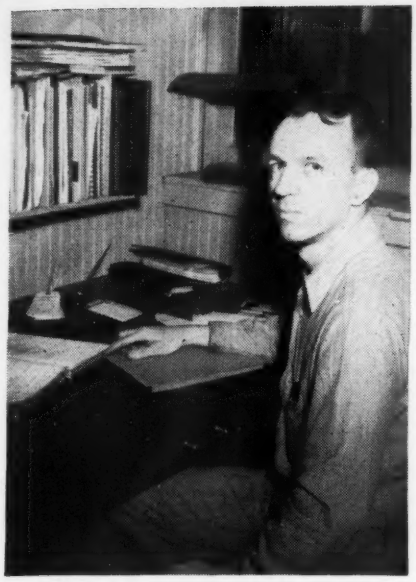
Displays Promote Farm Wiring

To help clear up the farm wiring bottleneck is the job of the recently organized Farm Wiring Coordinating Committee. Headed by J. S. Webb, agricultural engineer of the Philadelphia Electric Company, Philadelphia, Pa., the group is composed of representatives of the (National Electrical Manufacturers Association's) Farm and Rural Market Committee and the National Adequate Wiring Bureau. All are experienced in adequate wiring and farm electrification programs. Details are being handled by the NEMA Farm Electrification Bureau, 155 East 44th Street, New York 17, N. Y.

Moving into the wiring picture about 18 months ago, the committee concluded that farmers could not be expected to "buy" adequate wiring unless they were "sold" on it; to interest them in sound, engineered wiring installations required more than a sales talk; and the story of farmstead wiring adequacy must be carried to educational institutions, as well as to contractors, power suppliers and others concerned with the problem.



In charge of construction activities at Lansing Electric Motors, Lansing, Mich., is Lynn Kestenholtz, partner in the firm. Industrial and commercial work are their specialty.



Shop Superintendent D. L. Murrie has charge of the motor repair work at Central Electric Motor and Construction Co., Battle Creek, Mich.; gained valuable experinece in equipment maintenance and repair while aboard ship during the war.

In line with its efforts to satisfy these three basic conclusions, the committee has developed its first promotional-educational aid, a set of five display pieces. All are in color; each is 30 by 40 inches in size. The basic display is a 7-color piece which shows a perspective of a farmstead complete with load center installation. The other display pieces present isometric or skeletonized sketches of each of the following farm structures shown on the perspective: farm residence, dairy barn, poultry house, workshop and granary. Use of the isometric technique permits observers to "look inside" the various structures and see what the committee recommends in the way of electrical equipment for household and for farm production use.

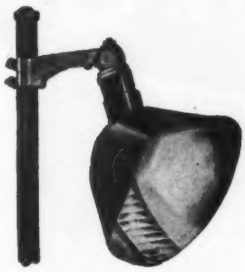
The colorful sets are designed to provide display pieces for use by power suppliers and others at fairs and in lobbies and windows; to illustrate discussions about farm wiring at meetings of farm organizations, rural youth groups and school classes; and for presentation during conferences with rural personnel. The sketches are so drawn as to provide necessary "room" for adaptation of layouts to various local conditions. The end result, it is hoped, will be to help the farmer sell himself on the value and need for adequate wiring, and thus make the necessary follow-up planning and "order taking" job a mutually agreeable and understandable operation. Sets may be purchased at $2 each through the NEMA Farm Electrification Bureau, 155 East 44th Street, New York 17, N. Y.

The boss on the job says—

"That's what I call Good Design and Construction

QUAD LIGHTING

ANGLE REFLECTORS FOR SIGNS



FLOODLIGHTS FOR AREA LIGHTING

POST TOP OR PUMP ISLAND REFLECTORS

It's easy to see why men who do the wiring are strong for QUAD. Among the things that please the boss is the ease of wiring and the hearty O. K. he gets from customers for all around good installations.

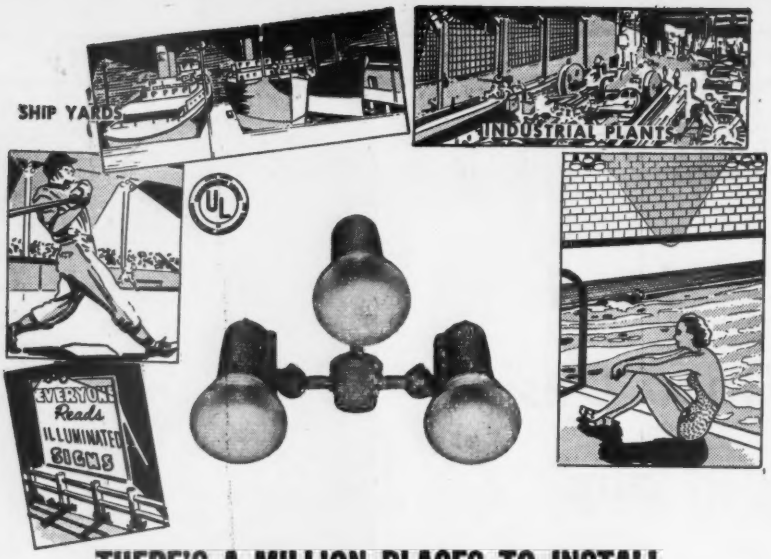
You'll find the correct unit for most outdoor lighting requirements in this modern and complete line. You'll also find that these units are flexible in design, fully weatherproof, and that the porcelain finish is permanent.

Make QUADRANGLE your headquarters for those outdoor lighting jobs. make QUADRANGLE your headquarters for those outdoor lighting jobs and build a more profitable installation business.

• *Always refer to the QUAD catalog . . . it's most helpful. If you haven't a copy write for one.*

QUADRANGLE MFG. CO.

32 S. PEORIA ST. CHICAGO 7, ILL.



THERE'S A MILLION PLACES TO INSTALL

STONCO

MULTI-LITE SYSTEMS

More places than you've probably dreamed of! Outdoors—indoors and where moisture is present. Stonco has a list that will open your eyes. Why not send for it today. It's free.

Build your business with Stonco ideas—And build your repeat business with Stonco equipment. Its years of trouble free operation and economy will bring you the kind of satisfied customers that spell steadily increasing profit.

Sold exclusively thru recognized distributors UNION MADE

STONCO

STONE MANUFACTURING COMPANY

489 Henry Street Elizabeth 4, N. J.

THE MAGNO-TRONIC FLUORESCENT STARTER

PROTECTS Fully, automatic thermal relay with unusually long life that eliminates blinking lights and protects all auxiliary equipment

SIMPLIFIES Replacement of worn-out lamp automatically restores closed circuit—replacement of starter unnecessary. No button to push.

REDUCES COSTS Magno-Tronic starters provide exact timing in the lamp electrode—preheating process preventing excessive loss of emission material, thereby assuring the maximum in the useful life of a lamp. The established quality of this starter saves considerable time in maintenance and man hours required to repair and/or replace an inoperative lighting unit.

VERSATILE Will operate efficiently over an extended voltage range under widely varying temperatures.

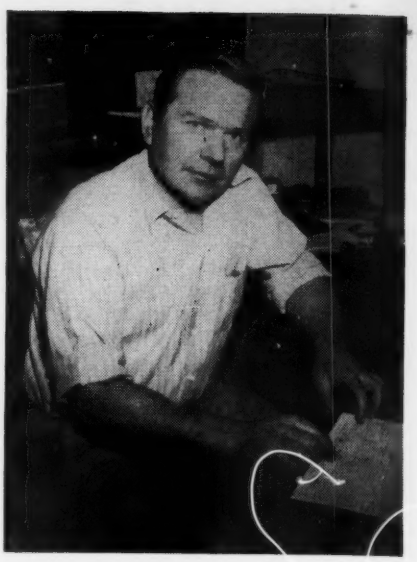
GUARANTEED FOR ONE YEAR.

The (SP-15-20) for use with either 15 or 20 watt lamps
The (SP-30-40) for use with either 30 or 40 watt lamps
The (SP-100) for use with 100 watt lamps

Ask for descriptive literature

INDUSTRIAL ELECTRONICS CORP.

MAIN PLANT Newark 2, N. J.



Customer satisfaction is the slogan of C. W. Galen, whose Commercial Electric Company specializes in motor repair work in Battle Creek, Michigan. Formerly an assistant superintendent of a manufacturing plant, Galen knows the value of good workmanship and service.

4-Year Program for Low-Income Farmers

A four-year, $275-million program designed to improve the housing of the part-time and low-income farmer who can't get credit from other sources is now in the Congressional stage. Loans and grants will be made for bringing electrical power to the house or barn, installing necessary interior wiring, purchase of electric pumps and similar equipment.

Representing the Dept. of Agriculture's Farmers Home Administration are 1,500 local field agents scattered throughout the country—one for every two agricultural counties.

If Congress approves the entire act, the amount to be paid out in loans during the next four years will total $250-million; and grants during the same 4-year period will total $25-million.

No loans can be made to tenant farmers, but loans will be made to farm owners to improve their tenant farms.

The Farmers Home Administration spells out the high points of the program as follows:

The average loan will run around $2,200. The southeastern farm states will benefit most.

The bill sets up three classes of farmers who can benefit from the new law: (1) Those whose farms produce enough income to repay a loan; (2) Those whose farms could—but don't—produce enough income to repay a loan; and (3) Those whose farms don't and won't produce enough income to pay off a loan.

National Joint Board To Continue

National Electrical Contractors Associations, seven other specialty contractor associations and the Associated General Contractors have agreed to continue the National Joint Board for settling jurisdictional disputes, subject to some changes suggested both by the contractors and the AFL Building Trades Dept.

The jurisdictional disputes settling plan, in effect since May, 1948, has been re-established and will function under the old rules until changed. The AFL gave notice of termination of the plan, effective July 1, but later changed its mind when Congress failed to repeal the Taft-Hartley Labor Law. Also, the National Labor Relations Board has held that under the Taft-Hartley Law, contractors have a right to assign work if it does not conflict with an NLRB certification and is not discriminatory.

Changes tentatively agreed to by a negotiation committee with representatives of the contractors and the AFL are subject to ratification by the building trades as well as the contractors.

Book Reviews

Radio Service

"How to Service Radios with an Oscilloscope", designed as a practical reference manual for radio, television and amplifier servicemen, radio operators, students and electronic technicians, is a 72-page instruction booklet containing tables, diagrams and schematic circuits including many waveform patterns as they appear on the face of the oscilloscope in actual service applications. The text is grouped into eight main sections devoted to oscilloscope fundamentals, linear time base, the complete oscilloscope, voltage measurements, radio receiver servicing, audio amplifier testing, transmitter testing and miscellaneous applications.

Special applications described include AM and FM receiver alignment, the location of hum, signal tracing, trouble shooting, identification of faults through oscilloscope pattern, checking AVC action, voltage gain measurement, auto radio vibrator tests, peak current check in rectifiers, impedance measurement and capacitor filter check.

Published by the Radio Division of Sylvania Electric Products, Inc., 500 Fifth Avenue, New York 18, N. Y., the book is priced at $1.00 and measures 8½-by-11 inches in size.

NO MORE BULGING SPLICES when you use "Scotch" No. 33 Electrical Tape. Electrical Contractors, Inc., of Chicago, used this tough, thin tape for splicing in a large housing project at Elmhurst, Ill. Thousands of 5-way splices like this one were made, each easily tucked into standard fixture openings without stuffing or pressing.

This tape knocks the "stuffing" out of wiring jobs

Looking for a way to end bulging junction boxes and fixture openings? Let us show you how with this amazingly thin, surprisingly tough plastic tape. It's bringing faster, cleaner splicing to contractors everywhere.

Available in the 20 ft. by ¾ inch "Job Size" roll, packed 12 rolls to a tube, and the 66 ft. by ¾ inch "Economy Roll" packed in individual cans. Your electrical jobber has it.

TRY IT AT OUR EXPENSE—Sample roll plus complete details free on request to Dept. EC-9. Write today!

Quick Facts About "SCOTCH" No. 33 Electrical Tape

- **TOUGH**—plastic backing is abrasion resistant, unaffected by water or weather.
- **STRETCHY**—conforms snugly to uneven surfaces, odd shapes.
- **HIGH DIELECTRIC STRENGTH**—over 7,000 volts.
- **THIN CALIPER**—only .007 inch thick, takes less room, gives neater jobs in all insulation work.
- **QUICK**—pressure-sensitive adhesive holds at a touch. Only *one* tape and *one* operation needed for all common electrical jobs.

★ **P. S.** For high-heat insulation use "Scotch" Electrical Tape No. 27 with glass cloth backing—thermo-setting adhesive.

SCOTCH BRAND No. 33 Electrical Tape

ANOTHER 3M COMPANY PRODUCT

Made in U. S. A. by

MINNESOTA MINING & MFG. CO. SAINT PAUL 6, MINN.

also makers of "SCOTCH" Pressure-sensitive tapes, "UNDERSEAL," "SCOTCHLITE," "3M" Abrasives, "3M" Adhesives.

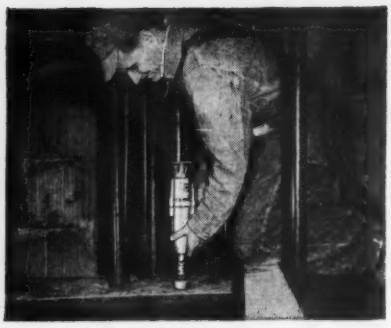
GENERAL EXPORT: DUREX ABRASIVES CORP., 240 NORTH AVE., NEW ROCHELLE, N. Y.

IN CANADA: CANADIAN DUREX ABRASIVES LTD., BRANTFORD, ONTARIO

REDUCE YOUR NUT-RUNNING TIME as much as 90% with Ingersoll-Rand

ROTARY ELECTRIC IMPACTOOLS

Size 4U—3/8" bolt dia.
Size 8U—5/8" bolt dia.



Here's Proof of

AMAZING IMPACTOOL SAVINGS

Production Job . . . .

A fabrication process required removing rusted and cement coated nuts from 5/8" steel rods. With hand wrenches 60 units were turned out in a day. The Impactool jumped production to 150 units per day and the $197 tool paid for itself in less than 11 days.

Maintenance Job . . . .

Servicing transformers required the removing and replacing of transformer shields. Hand wrenches took 90 minutes; the Impactool did the job in only 9 minutes. The $110 Impactool paid for itself in less than 10 days.

Construction Job . . . .

A western building contractor used 2 Impactools to drive 1/2"x4" lag screws and run nuts on 3/8" bolts during house construction. The Impactools paid for themselves in the construction of 5 houses.

Versatile Impactool Saves 64 Man Hours on One Operation . . . .

Hand tools took 80 man hours to roll 300 3/4" boiler tubes. The Impactool, with a special tube rolling attachment, cut the time to 16 man hours. The tool costing $165 paid for itself in 13.8 hours' use.

Ask your distributor for a free demonstration.

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.

ORIGINATOR OF IMPACTOOLS—air and electric

445-18

CORRECTION

A. A. Schuler's "Sound Powered Telephone System" in August had some transpositions in the captions which we regret. The wiring diagram on page 46 should be Fig. 2. The Riser diagram on page 47 should be Fig. 1. Also the two photos figures 3 and 4 should be interchanged. (i.e. the top right instrument shown is the Wheeler sound powered phone, the lower is the Hose McCann.)

Dates Ahead

International Association of Electrical Inspectors—Western Section, Hotel Statler, St. Louis, Mo., September 26-28; Northwestern Section, Butte, Mont., October 3-5; Southwestern Section, Hotel San Diego, San Diego, Calif., October 10-12; Southern Section, Hotel Shamrock, Houston, Texas, October 17-19.

Illuminating Engineering Society—National Technical Conference, French Lick, Ind., September 19-23.

Pennsylvania Electric Association—Annual meeting, Benjamin Franklin Hotel, Philadelphia, Pa., September 20-21.

National Electronics Conference—Edgewater Beach Hotel, Chicago, Ill., September 26-27.

International Municipal Signal Association—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., October 10-13.

International Association of Electrical Leagues — 14th Annual Conference, Cleveland Hotel, Cleveland, Ohio, October 12-15.

National Safety Congress and Exposition —Chicago, Ill., October 24-28.

Audio Engineering Society—"Audio Fair", Hotel New Yorker, New York City. October 27-29.

National Electrical Contractors Association—Annual convention, Rice Hotel, Houston, Texas, November 8-11.

National Electrical Manufacturers Association—Chalfonte-Haddon Hall, Atlantic City, N. J., November 14-18.

Sixth All-Industry Refrigeration & Air Conditioning Exposition—Atlantic City, N. J., November 14-18.

Plant Maintenance Show and Conference —Auditorium, Cleveland, Ohio, January 16-19.

American Society of Heating and Ventilating Engineers—Dallas, Texas, January 23-27.

Southwest Air Conditioning Exposition—Dallas, Texas, January 23-27.

American Institute of Electrical Engineers —Winter general meeting, New York, N. Y., January 30-February 3.

National Electrical Manufacturers Association—Edgewater Beach Hotel, Chicago, Ill., March 13-16.

Chamber of Commerce—38th Annual meeting, Washington, D. C., May 1-4.

National Fire Protection Association—54th Annual Meeting, Haddon Hall, Atlantic City, N. J., May 15-18.

National Electrical Distributors Association—Annual convention, Atlantic City, N. J., June 12-16.

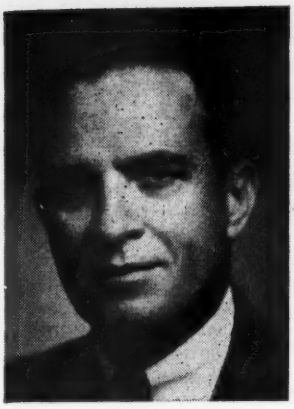
New Jersey Council of Electrical Leagues —Annual convention, Ritz-Carlton Hotel, Atlantic City, N. J., October 1-2.

Manufacturers News

U. S. RUBBER APPOINTEES

The appointment of Howard H. Weber as general sales manager of the wire and cable department, United States Rubber Company, has been announced.

Mr. Weber will supervise sales of rubber insulated building wire, service



H. H. WEBER

entrance cable, armored and non-metallic sheathed cable, portable cord and cord sets, Uskon electric radiant heating, battery separators, electric wiring devices and other specialized electrical wires for the radio, television, mining, construction and electrical industries.

GENERAL ELECTRIC APPOINTMENTS

To render greater customer service in the West Coast market, the Construction Materials Department of the General Electric Company, recently opened its new Pacific district warehouse at 3000 East 46th Street, Los Angeles. Daniel F. Flynn, Pacific District manager, will be located at this address. George F. Kingshot has been named the operating manager of the new warehouse.

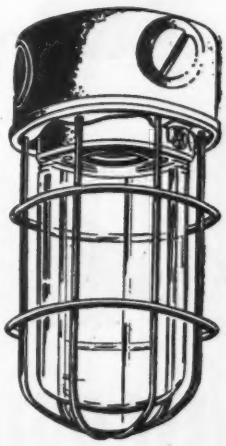
Formation of a new Northwest sales district for the Construction Materials Department was recently announced. The district will serve the wholesale trading areas of Seattle and Spokane, Washington; Portland, Oregon; Boise, Idaho; Salt Lake City, Utah; Butte and Billings, Montana. William W. Bryan of Pittsburgh has been named district manager.

Harold W. Parrott has been named operating manager of the new Southeastern district warehouse of the Construction Materials Department, located in Charlotte, N. C.

Lloyd C. Shackelford has been named a wire and cable specialist for the Construction Materials Department, with headquarters in Seattle, Wash. Edward J. Roddy, Jr. has been named a district representative. He will cover the wholesale trading areas of Zanesville and Columbus, Ohio, and will make his headquarters in the latter city.

Three new sales districts have been established in the nationwide sales organization of General Electric's Lamp Department. The new districts and managers are: Connecticut Valley Sales district, New Haven, Conn., with Elbert A. Hawkins as manager; Texas Gulf sales district, Houston, Tex., with George S. Trotter as manager; Puget Sound sales district, Seattle, Wash.,

Cure That ALPHABET HEADACHE *with* ADALET WEATHER-PROOF FITTINGS



One type of ceiling fitting—just one—is all you need on *any* job.

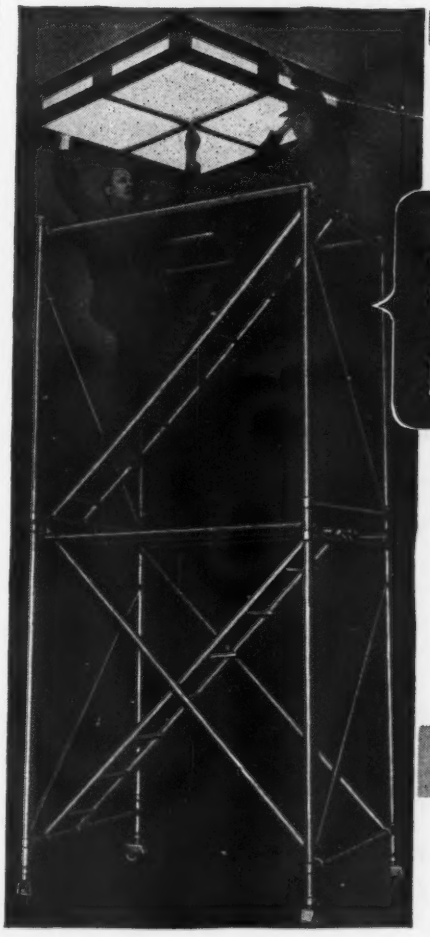
Fitting has four tapped hubs. Unused hubs are sealed with threaded plugs. One fitting takes the place of *five*.

Easy to order. Easy to stock. Easy to install. Easy to maintain—guard positively cannot fall off.

A complete line—with or without reflectors. *Write for full details and prices.*

THE ADALET MANUFACTURING CO.

14300 LORAIN AVE.
CLEVELAND 11, OHIO



"Saved Hundreds of Man Hours"
says E. C. Thirlwell, Jr., prominent electrical contractor of Louisville, Ky.

Aluminum Alloy "UP-RIGHT" SCAFFOLDS

Can be erected at the rate of one minute per section! 6-foot and shorter sections available. Rolled easily from position to position throughout the job. Stronger than structural steel yet one third the weight. No wrenches, wing nuts, or bolts. Each section folds flat.

Write for Descriptive Circular

UP-RIGHT SCAFFOLDS

DEPT. 107 • 1013 PARDEE STREET
BERKELEY, CALIFORNIA

Factories: Berkeley, Calif. and Teterboro, N. J.
Sales Offices in All Principal Cities

NEW GUTH MAZELITE*

hook-on reflector.....
and those Turret Sockets are dandies, too!

That rugged reflector can take it because its GUTH 300° WHITE PERMALUX finish is high-baked to bonderized, zinc-coated steel—*can't* crack, check, chip, craze or peel. Gives over 85% light reflectivity, too!

No more tugs-o'-war trying to remove stubborn reflectors for cleaning! No nuts, clips or gimmicks to get lost or out of order! Mazelite hook-on Reflectors hinge from either side of channel or can be completely removed and replaced instantly.

The new MAZELITE's TURRET SOCKETS speed relampings. Lamps cannot work loose. We'll gladly send you our handy new Pocket Catalog 46A-A with full details about this and other outstanding lighting equipment—compliments of

Guth LIGHTING

YOUR TEAMMATE IN *precision-planned* LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902

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013

with Lloyd R. Wilson as manager. Mr. Wilson, who has been manager of the North Pacific sales district, Portland, Ore., will be succeeded in that position by Walter J. Pitblado, formerly manager of the Portland service district. Alex C. Ham has been named Portland service district manager.

L. V. James, veteran lighting engineer, has retired as district engineer after 43 years of service.

William A. Mulcock has been appointed manager of sales administration and forecasting of the automatic heating division of G-E's air conditioning department.

NEW APPOINTMENTS AT BIDDLE CO.

At a recent meeting of the Board of Directors of James G. Biddle Co., D. Robert Yarnall was elected chairman of the board and J. Robert James president of the company. Mr. Yarnall has been president since 1944 and Mr. James has been vice president and treasurer.

Edward H. Wannemacher was re-elected vice president and secretary. He is also sales manager and personnel director.

Additional appointments are E. E. Lange, assistant sales manager, A. Q. Lange, technical sales engineer, T. B. Whitson, director of Engineering, E. B. Curdts, assistant director of engineering and Stuart C. Sommer, advertising manager.

AMERICAN STEEL & WIRE APPOINTMENTS

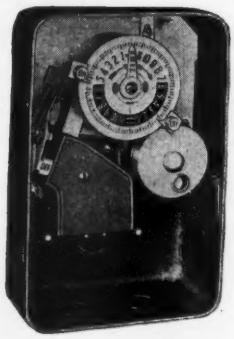
Appointment of American Steel & Wire Company sales officials to newly-established posts of area managers of sales has been announced. The three areas set up under the new territorial plan cover all sales districts served by the company.

Named to the post of eastern area manager of sales, with headquarters in New York, was Roswell F. Curtis, since 1945 the manager of the company's manufacturers' products sales division. Appointed to a similar post for the Central area, with headquarters in Cleveland, was Howard B. Maguire, the company's sales manager at Detroit since 1933. Named Western area manager of sales, with headquarters in Chicago, was Clarence T. Gilchrist, Chicago sales manager from 1937 to 1945 and since that date assistant general manager of sales for the Chicago district

To fill the vacancies created by these appointments, Norman M. Sted has been assigned to the post of manager of the manufacturers products sales division, at the company's headquarters in Cleveland; Maxwell D. V. Millard as manager of the Detroit district sales office; and Edward A. Murray as manager of the Chicago district sales office.

DOUBLE DEPENDABILITY

is the reason why more and more time switch buyers are specifying



INTER-MATIC

Dependable PRODUCT!
Dependable MANUFACTURER!

Specifications

- 35 ampere, 120 volt switch
- Self-starting, synchronous timing motor
- Manual control
- Automatic reset
- Sturdy terminal block, large terminal screws
- Combination ½" and ¾" knockouts in back, bottom and each side
- Drawn steel case with spring hasp to keep door closed
- Entire mechanism removed by loosening one screw
- Fully guaranteed and Underwriters' Approved

Write for complete details
INTERNATIONAL REGISTER CO.
2624 W. Washington Blvd., Dept. 99-B
Chicago 12, Ill.

$10.95 LIST f.o.b. factory, Chicago

INTER-MATIC TIME SWITCH

Lay that Ladder Down!

KETT TALL REACH WOOD BORER

DRILLS HOLES HIGH . . . LOW or in the HARD CORNERS

This sensational new tool pays for itself (users report) on the first two or three construction jobs. Drills holes through joists, concrete or steel. 11/16", 12/16" or 16/16" and expansion bits with range from 7/8" to 2 3/4" are available. Exclusive all-angle head permits drilling extremely close quarters in any direction. Use for wiring, plumbing or heating installations. No ladders, no more reaching, stretching and straining. Can be furnished with or without adjustable extension.

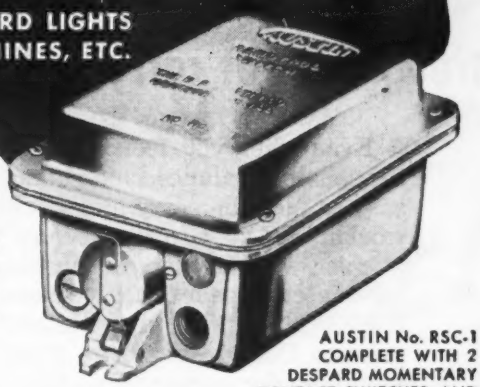
WRITE FOR BULLETIN No. F-9

The KETT Tool Company
5 E. THIRD ST., CINCINNATI 2, OHIO

Save Wire and Wiring Costs with the AUSTIN Remotrol

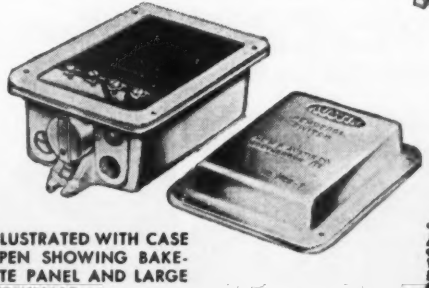
REMOTE CONTROL SWITCH

FOR OPERATION OF YARD LIGHTS PUMPS, MOTORS, MACHINES, ETC.



The AUSTIN Remotrol allows the installation of *any desired number* of momentary contact switches, thus providing maximum convenience at low cost. Remotrol eliminates the need for costly 3-way and 4-way switches—reduces substantially the amount of wire required by conventional systems.

AUSTIN No. RSC-1 COMPLETE WITH 2 DESPARD MOMENTARY CONTACT SWITCHES AND FUSTAT.



ILLUSTRATED WITH CASE OPEN SHOWING BAKELITE PANEL AND LARGE TERMINALS.

Remotrol is a thoroughly reliable indoor-outdoor switch unusually well designed and constructed, both electrically and mechanically, and housed in a heavy-duty rustproof cast aluminum case with two external lugs for easy mounting.

WRITE TODAY FOR REMOTROL BULLETIN

The M. B. Austin Company
NORTHBROOK, ILLINOIS

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THE
Easy-to-handle
GEARED
PIPE
THREADER

RIDGID No. 4P's handles take the struggle out of carrying and putting on pipe

● Even when you feel like a Tarzan you appreciate the sensible balanced loop handles that make the 4P easy to pick up, carry and work with. Mistake-proof workholder sets to size *before* you put it on pipe, one screw to tighten, no bushings. 4 sets of 5 high-speed steel chaser dies give clean accurate threads on 2½," 3," 3½" and 4" pipe. Ratchet handle furnished—RIDGID Universal Drive Shaft and Power Drive available for power-threading. For perfect threads easily, order the RIDGID 4P from your Supply House.

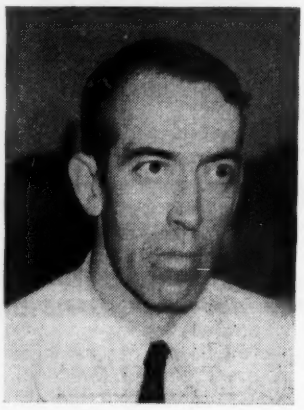
RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

Robert M. Page has been appointed manager of Worcester, Mass. district sales, succeeding F. Kenneth Sawyer, who retired after 44 years of service with the company.

Paul Ketring was named director, cold rolled strip sales, at company headquarters in Cleveland; Harry F. McAnerney to assistant manager, manufacturers products sales division, at Cleveland; James R. Mohr to assistant manager, Detroit district sales; Fred L. Nonnenmacher to manager of manufacturers products sales, Chicago; and Frank T. Clarke to manager of manufacturers products sales, New York.

CENTURY ELECTRIC APPOINTMENT

The appointment of Fred H. Pillsbury as vice president in charge of operations of the Century Electric Company of St. Louis, has been announced. He was formerly executive engineer and has been a member of the board of directors for the past eight years.



F. H. PILLSBURY

Mr. Pillsbury joined the organization in 1927 after graduating from Washington University and was assigned to various departments within the company.

WESTINGHOUSE CHANGES

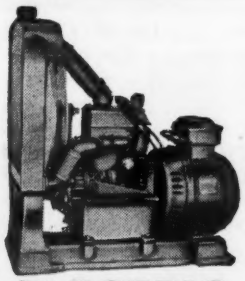
Frank L. Snyder has been appointed manager of Westinghouse Electric Corporation's Transformer Division in Sharon, Pa. He succeeds John K. Hodnette, vice president, who recently became general manager of industrial products with headquarters in Pittsburgh.

Succeeding Mr. Snyder as transformer division engineering manager is John H. Chiles, Jr.

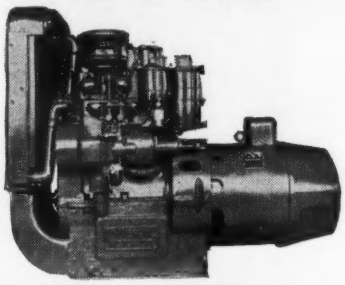
C. H. Bartlett has been made sales manager for the transformer division, succeeding W. W. Sproul, who has been named sales manager of industrial products for the entire company.

The appointment of W. J. Howell as assistant to Tomlinson Fort, manager of apparatus sales for the Westinghouse Electric Corporation, Pittsburgh, has been announced.

UNIVERSAL



ELECTRIC



PLANTS

All sizes and types, gasoline and Diesel, A.C. and D.C., to 35 kw. For all purposes. Send for literature and prices!

UNIVERSAL MOTOR CO.

Founded in 1898

438 E Universal Drive, Oshkosh, Wisconsin

"JUST A SNAP" FOR BOTH AC AND DC

QUICK READINGS WITHOUT BREAKING CIRCUIT Instant current readings by merely placing the tongs around the electrical conductor—without breaking circuit or insulation. It's safe, convenient and accurate. Tong Test is the only ammeter of its type that can be used on both AC and DC. Cannot burn out for it has no windings. Interchangeable scale ranges up to 1000 amperes. Five types to accommodate cables up to 3 7/8", bus bars up to 4 1/2" x 1/2". Voltage readings, too, with the Voltor Attachment.

Write for Tong Test Bulletin CM-400

COLUMBIA ELECTRIC MFG. CO.

4541 Hamilton Ave., Cleveland 14, Ohio

Millions of Steel

JIFFY CLIPS

Serving the Electrical Industry

Specify

MINERALLAC

HANGERS, CLIPS, STRAPS, BUSHINGS

Expert design, choice materials and controlled manufacture have built "top-service and longest life" into Minerallac Electrical Specialties. That's why the electrical industry "prefers Minerallac"... In steel and Everdur for hanging pipe, conduit, BX cable, etc.

Send for new literature and prices.

MINERALLAC ELECTRIC COMPANY

25 North Peoria Street—Chicago 7, Illinois

MINERALLAC

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FULL HOUSE!

EVERYTHING FOR THE COMMERCIAL OR INDUSTRIAL ELECTRIC REPAIR SHOP!

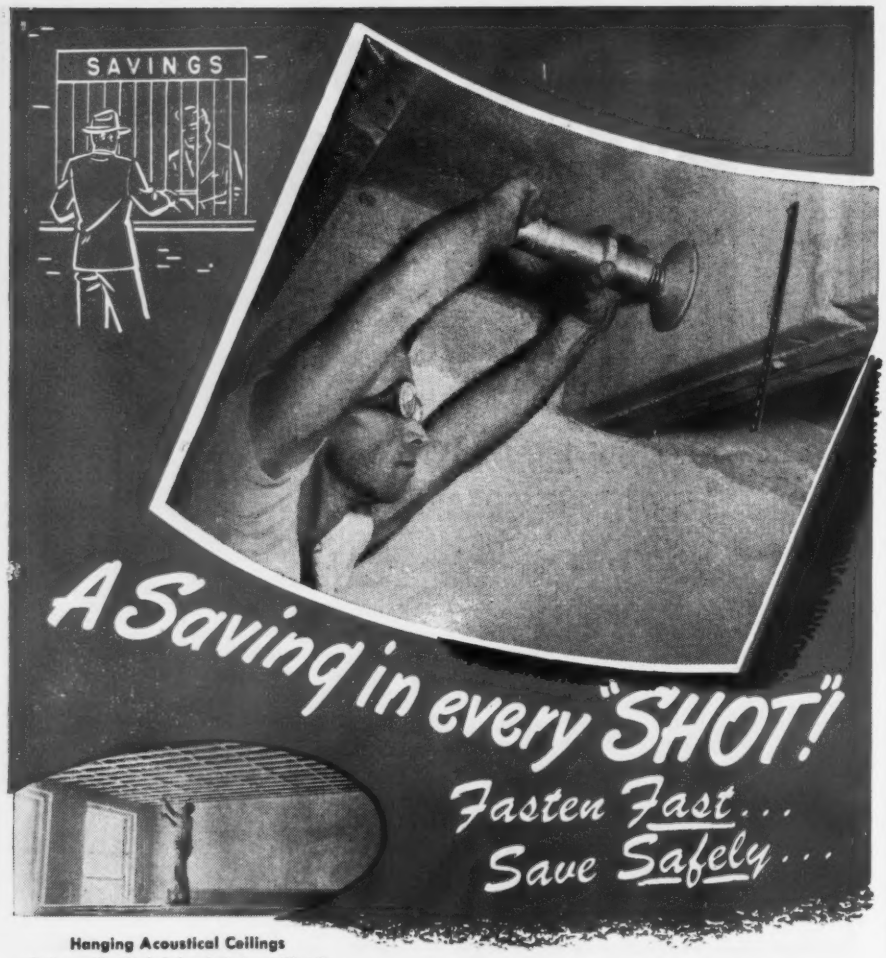
WRITE FOR FREE, 238 PAGE ILLUSTRATED CATALOGUE

(On Your Letterhead, Please)

COMPLETE - READING ELECTRIC CO., INC.

102 S. JEFFERSON ST., CHICAGO 6, ILL. . . TELEPHONE: CENTRAL 6-5390

"Your Best Source of Supply"



Hanging Acoustical Ceilings
Painesville High School, Painesville, O.

DO IT with DRIVE-IT!

● A Drive-It tool . . . a small power charge . . . a drive-pin . . . that's the three-way formula for fast fastening which is saving thousands of dollars every day on construction jobs coast to coast.

If you're still wasting time and money by using old-fashioned "dig and drill" methods for fastening steel or wood to concrete or steel, better get the facts on DRIVE-IT, the modern "split-second" fastening system. It's safe, easy on your men and on *your pocketbook!*

A choice of tools and power loads for light or heavy work . . . plus a wide selection of drive-pins. There's sure to be one for *your* particular job!

Write us *now* for the facts on Drive-It and for the name of your nearest Drive-It distributor. He'll be glad to arrange a demonstration.

Model 222 for light fastening

Model 238 for heavy fastening

U.S. Pat. No. 1,984,117; 2,400,878

Distributors Coast-to-Coast
Canadian Distributor: AMMO-POWER TOOL CO., LTD., Ft. of McLean Drive, Vancouver, B. C.

POWDER POWER TOOL CORPORATION
0702 S. W. Woods St. Portland 1, Oregon

DON'T DRILL IT... DRIVE-IT POWDER-POWER TOOL

DRIVE-IT
THE MODERN MIRACLE TOOL

EUCLID ELECTRIC ELECTS NEW VICE PRESIDENT

At the last board of directors meeting, the Euclid Electric and Mfg. Co. of Madison, Ohio, elected C. J. Rowles vice-president in charge of sales.

C. J. ROWLES

Mr. Rowles joined Euclid Electric after many years as an industrial salesman for General Electric Company.

FRED SCHMIDT JOINS I-T-E

Fred Schmidt, formerly president of Electric Power Equipment Corp., has recently joined the I-T-E Circuit Breaker Company as assistant to the

FRED SCHMIDT

president. He will be responsible for the coordination of various sales and engineering activities within the company.

After graduating from Pennsylvania State College, Mr. Schmidt spent four years with the switchgear division of the General Electric Co. He then went into the United States Navy and after his release in 1945, he joined the Electric Power Equipment Corp.

WESCO APPOINTMENTS

Russell N. Chapman has assumed the duties of general farm sales manager for the Westinghouse Electric Supply Company at the executive headquarters in New York City. Prior to

1 MAN CAN DO THE WORK OF A CREW...

with an

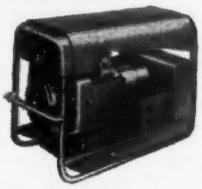
ONAN *Portable* ELECTRIC PLANT

Use Electric Tools on Every Job!

Speed the work, cut costs on installation and maintenance jobs. Lightweight Onan air-cooled electric plants supply electric power anywhere for lights, drills, saws, hammers, spades and other motor-driven tools. Equipped with carrying handles or dolly-mounted. Take 'em anywhere and plug in for all the power you need.

SHIPPED COMPLETE READY TO RUN

Gasoline powered models— A. C.: 350 to 35,000 watts. D. C.: 750 to 15,000 watts. *Diesel plants:* 2,500 to 55,000 watts.



Write for Folder

Model 5CK, 5,000 watts D. C. Weighs only 315 lbs.

D. W. ONAN & SONS INC.
3169 Royalston Avenue
Minneapolis 5, Minnesota.

For unexcelled dependability and permanence

Specify and Install

AEMCO **TIME SWITCHES**

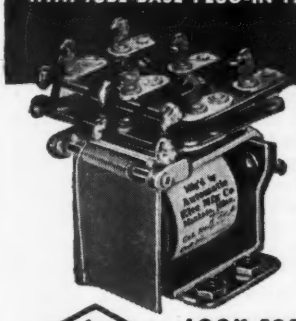
EQUIPPED WITH SYNCHRONOUS, SELF-STARTING MOTORS

A. C. OR D. C. OPEN OR CAN TYPE WITH TUBE-BASE PLUG-IN FEATURES

Highest quality material and unexcelled craftsmanship combine to make Automatic Time Switches the preference of those who demand *long life dependability backed by an unconditional guarantee.*

Compact, *carefully engineered* Automatic Time Switches have new type, easily set trip levers. Trip levers and dial are visible thru window in attractively finished, tamper-proof case.

Stock Models: Single Circuit, Single Pole, 10 Amperes Capacity to Two Circuit, Four Pole, 45 Amperes Per Pole Capacity. Special models engineered to your requirements.



AEMCO **RELAYS**

Automatic Electric Relays . . . Midget, Interlocking, Circuit Control, Latching, Adjustable . . . are built to exacting high standards to assure unexcelled dependability. Custom built relays designed to your specifications.

Accurately rated Automatic Electric Relays deliver "Diamond Quality" performance.

Write for complete specifications.

LOOK FOR THE DIAMOND SEAL FOR DIAMOND QUALITY

AEMCO *Automatic Electric* **MFG. CO.**

50 STATE STREET
MANKATO, MINNESOTA

ILSCO

ELECTRICAL *Connectors-Accessories*

COMPARE VALUES
COMPARE PRICES
Above All
COMPARE QUALITY AND PERFORMANCE

Be sure to get
YOUR 80-PAGE MANUAL

The most complete manual on electrical connectors and accessories. Color photographs, charts, data, technical, engineering and other valuable information. Write today.

WRITE ON YOUR LETTERHEAD TODAY FOR COPY

ILSCO COPPER TUBE & PRODUCTS, INC. CINCINNATI 27, O.

ADJUSTS WITH A TWIST OF THE WRIST

PAT. 150,820 9/7/48

"Friction Set"
Fixture Hangers
FOR INSTANT ALIGNMENT

At last you can get a Fixture Hanger that turns to any angle after being screwed to an outlet box. Although base and receptacle remain stationary, hanger arms may be turned to align with any preconceived lighting plan. Exclusive Friction Ring firmly holds fixture in selected position. Hanger screws on to 3¼" or 4" outlet boxes, no other fastening necessary. Furnished complete with receptacle, two 5' chains, hooks and cord clips. Also available with bushed hole only, or with 3 wire solid ground receptacle. All Friction-Set Hangers are approved by the Underwriters' Laboratories.

K100 shown above, List Price $1.10 • *Write for Bulletins K25, K26 and K27*

SIMPLET ELECTRIC COMPANY
3600 West Potomac Avenue, Chicago 51, Illinois
11 Park Place, New York 7, New York

IF IT'S WORTH BUYING,
IT'S WORTH
Maintaining
"Superior"
No.1 LECTURETTE
Your motor and generator efficiency depends mainly upon the operation of your carbon brushes, which are *precision instruments*. Your motor brush manufacturer is best qualified to recommend the right brush grade for reducing maintenance costs. During the war two thumb-size motors fired enormous battleship guns. If the brushes failed, a million dollar floating arsenal might be lost. Perhaps we can help *you* avoid serious losses and gain maximum performance.
SUPERIOR CARBON PRODUCTS, Inc.
9113 GEORGE AVENUE, CLEVELAND 5, OHIO
"Since 1919"
SUPERIOR CARBON BRUSHES

"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION
Supporting conduit parallel to beam.
Supporting pipe at right angle to beam.
For Non-Slip Support of Conduit—At Any Angle
"EFFICIENCY"
Conduit Hanger
Type F
Write for Catalog 38-A
Type F Efficiency Conduit Hangers . . . with radiating ridges and five point gripping surface . . . carry pipe or conduit at any angle to beam on true mechanical principle. Made in ½" to 2½" diameter, for all open steel construction requirements. Write today.
Efficiency
East Palestine, Ohio
ELECTRIC AND MANUFACTURING CO.

this appointment, he has served as headquarters training supervisor for the Supply Company.

Wesco has opened a new branch at 75 Hickory Street, Johnstown, Pa. Z. W. Pique, formerly Pittsburgh Metropolitan apparatus and supply manager, has been appointed branch manager for the new house.

Announcement has been made of the appointment of N. C. Doxen as South Atlantic District farm sales supervisor, with headquarters at Baltimore, Md. Mr. Doxen, at present, is Wesco South Atlantic District apparatus and supply sales promotion manager, and will continue in this position in addition to his duties as district farm sales supervisor.

ARROW-HART & HEGEMEN APPOINTMENTS

Five promotions and additions in the sales department of Arrow-Hart & Hegeman Electric Company, have been announced. They are: Howard J. Varley, sales manager of appliance division, promoted to assistant director of sales of the entire company; Gordon Britt, appointed to succeed Mr. Varley as sales manager of appliance division; P. T. Galt, Jr., appointed manager of the industrial controls division; Charles H. Tuttle, appointed sales manager and John C. Ellis, assistant sales manager of the latter division.

SYLANIA ELECTRIC CHANGES

Appointment of F. H. Heintz as division sales manager of the Southwestern division, Sylvania Electric Products, Inc. has been announced. Mr. Heintz, formerly assistant division sales manager in Chicago, will have his offices in Kansas City, Mo. He replaces J. C. Hicks, who has been appointed sales manager of Sylvania's Canadian subsidiary, Sylvania Electric (Canada) Ltd.

H. L. Schreiner has been named field representative in Sylvania's Los Angeles Division office. He was formerly with the Rheem Manufacturing Co., South Gate, Calif., as sales promotion manager in the Los Angeles area.

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Fairbanks, Morse & Co., has announced the appointment of Frank M. Mason, Jr., as director of engineering. He will continue to be located at the firm's headquarters office in Chicago, Ill.

•

Alan E. Aune, who was formerly manager of aircraft and automotive wire sales for United States Rubber Company, has joined **Burndy Engineering Company, Inc.**, New York City.

How to install, maintain and service electronic control equipment

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Electrical and electronic technicians will find this book a guide to the practical application of industrial electronic control. Designed to bring you today's best methods and practices in the field, it covers everything of importance to the man on the job—from the very simplest electrical circuit, to the more complicated circuits of electronic motor control and welding control. Step-by-step, it covers the use and adaptation of tools and instruments for electronic equipment trouble shooting, and the installation, maintenance and servicing of specific types of equipment.

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- electronic resistance-welding control
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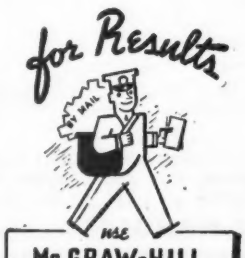

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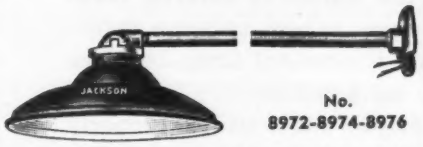

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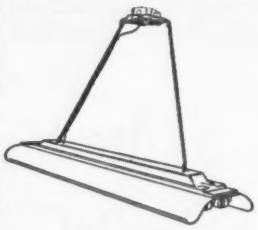

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ACME ELECTRIC CORPORATION
369 WATER ST. CUBA, N. Y.

Acme ACME Electric

Triangle Conduit & Cable Co., Inc., New Brunswick, N. J., has established warehouse facilities in Chicago at the Polk Street Station (Pennsylvania R. R.) 323 W. Polk St. The warehouse will be operated out of the company's Chicago district office, 600 W. Jackson Blvd., under the supervision of John Defontaine.

•

The appointment of N. O. Reed representing **Day-Brite Lighting, Inc.,** has been announced. He will maintain headquarters in Houston, Texas and cover the Houston territory under H. A. Auchter, Texas representative located in Dallas.

•

Standard Transformer Company, Warren, Ohio, has announced the appointment of Rietze and Company, 139 South 5th St., Louisville, Ky., as its representative in the State of Kentucky.

•

L. C. Richardson has been named sales representative for the **Ridge Tool Company's** Inter-mountain territory, with headquarters in St. Louis. The states under Mr. Richardson's supervision are Missouri, Kansas, Colorado, Arkansas, and Wyoming.

•

Automatic Control Co. of St. Paul, Minn, has announced the appointment of A. T. Timmerman, 759 N. Milwaukee St., Milwaukee, Wis., as its representative for eastern Wisconsin and Michigan peninsula territory.

•

The Thomas W. Bullock Company, Louisville, Ky., has been appointed sales agent for **General Switch Corporation,** Brooklyn, N. Y., covering the territory of southern Ohio, Kentucky, southern portion of West Virginia, and western Tennessee.

•

Kuhlman Electric Company, Bay City, Michigan, has announced the establishment of an eastern division sales office at 420 Lexington Avenue, New York City, and has appointed O. M. Hullinger as eastern sales manager.

•

The Harris-Hanson Company of St. Louis, Mo., has been appointed to represent **Cannon Electric Development Company** of Los Angeles, Calif., in the central and eastern portions of Missouri and central and southern Illinois.

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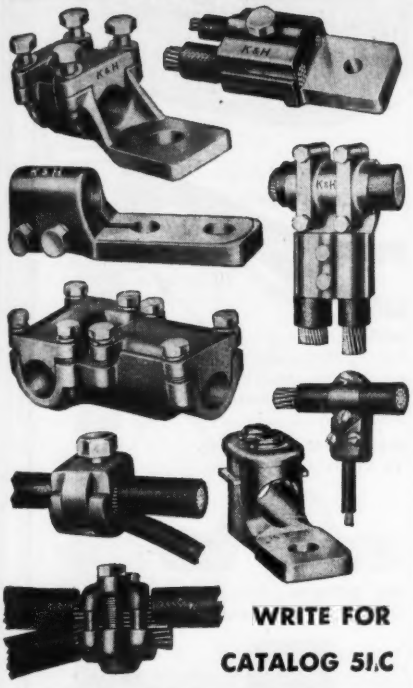

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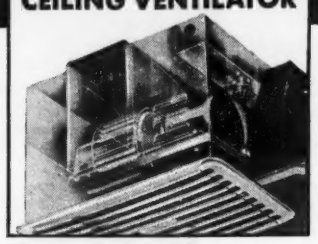

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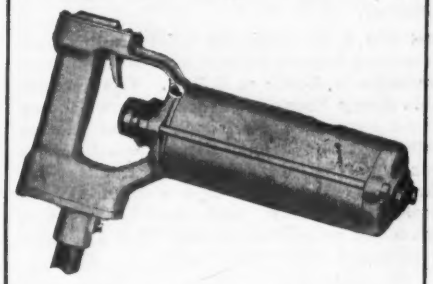

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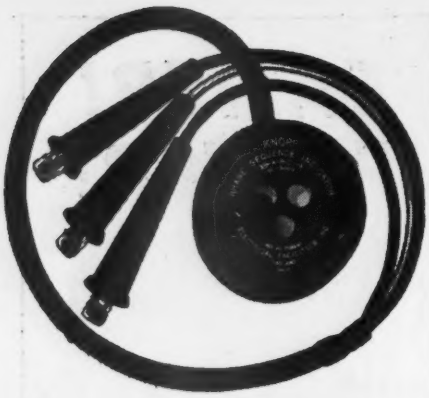

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Now you can save time in checking poly-phase connections and be sure they're RIGHT when you use the Knopp Phase Sequence Indicator.

Just clip it on, push the safety button and determine beyond a doubt whether the phase sequence is A-B-C; or C-B-A. This dependable Knopp Phase Sequence Indicator shows phase sequence by direction of disc rotation rather than by lamps. Gives correct indication regardless of voltage or circuit conditions without changing taps or dials. It does protect equipment and assures properly connected poly-phase wiring: 50 to 500 volts, 3 phase, 3 wire, 25-60 cycles.

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It stands up under rough field use and gives accurate and reliable service. It is made by Electrical Facilities Inc., technical electric equipment manufacturers of 21 years experience. *This* indicator has a *laminated* bakelite housing and no exposed metal parts. It is built for *complete* safety. Fully insulated clips can remain attached between tests as safety push button permits indication only when needed. Weighing but 21 oz., the Knopp Phase Sequence Indicator is small and easy to carry. Price $25; with leather carrying case, $30. Order today or write for complete description.

ELECTRICAL FACILITIES INC.

4232 Holden Street Oakland 8, Calif.

The Wagner Electric Corporation of St. Louis, Mo., has announced the appointment of R. E. Bryant as manager of the automotive and electrical branch at Buffalo, N. Y.

•

Revere Electric Mfg. Co., Chicago, has announced the appointment of Wynne Snoots Co., of Dallas, as its new Southwest sales representatives, covering Texas and New Mexico.

•

Formation of a truck body division which will manufacture a complete line of parts suitable for assembly into any desired type of commercial body has been announced by **Artisan Metal Works, Company,** Cleveland. Randall R. Burden, sales director, will head the new division.

•

The appointment of Lloyd M. Hershey as director of research for **General Instrument Corporation,** Elizabeth, N. J., has been announced.

•

Raytheon Manufacturing Company has named Art Cerf & Company, Newark, N. J., as sales representative for its voltage stabilizers in the upper New York State area.

•

Wayne C. Beitel, formerly with the Webster-Chicago Corp., has joined **Eicor, Inc.,** as sales manager of the firm's tape recorder division.

•

J. E. White, 1802 South Seventh St., St. Louis, Mo., has been appointed distributor for **Hobart Brothers** and will operate under the name of Hobart Welder Sales & Service.

•

Litecraft Manufacturing Co. has moved its offices from Newark to 104-114 South 4th Street, Brooklyn, N. Y.

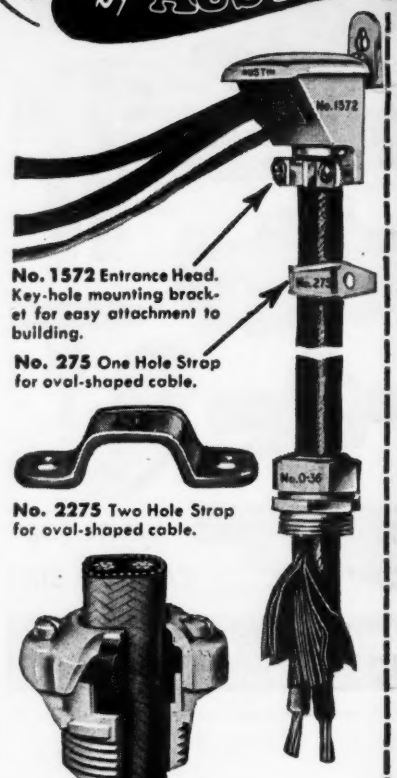
•

E. R. Traxler has been named manager of the new flat belting field engineering and development department of the **B. F. Goodrich Company's** industrial products division.

•

Appointment of the Industrial Supply Company, Inc., Salt Lake City, as distributors for Nelson Stud Welding equipment in the states of Utah, Montana, and portions of Idaho, Wyoming and Nevada has been announced by the Nelson Stud Welding Division of **Morton Gregory Corporation.**

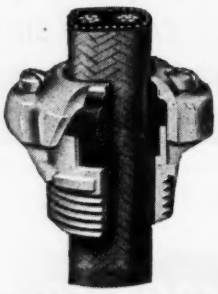
ENTRANCE CAPS AND FITTINGS of Rustproof Cast Aluminum Alloy by AUSTIN



No. 1572 Entrance Head. Key-hole mounting bracket for easy attachment to building.

No. 275 One Hole Strap for oval-shaped cable.

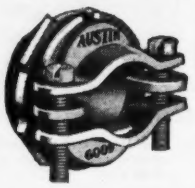
No. 2275 Two Hole Strap for oval-shaped cable.

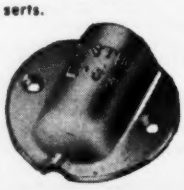


No. SO-36 Watertight Connector. Cutaway view illustrates how 3-point compression forces rubber gland around entire circumference of cable.

No. GR-1 Grounding Ring. For bonding meter box to artificial ground. Tight connection and positive bond without soldering.

No. 6009 Non-watertight Connector. Takes a wide range of sizes and types of cable, round or oval, without the use of shims or inserts.





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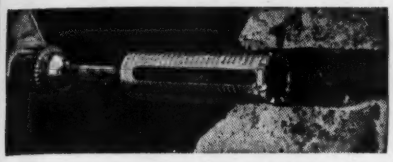

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(driven by ordinary electric drill)

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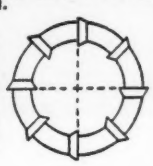

TILDEN KONKRETE KORE DRILL (right) drills much smaller area of hole. Has no point to retard cutting. All drills have from 3 to 24 cutters depending on size of drill which travel at best cutting speed, give fast, efficient action.

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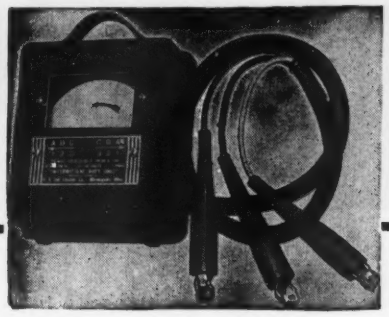

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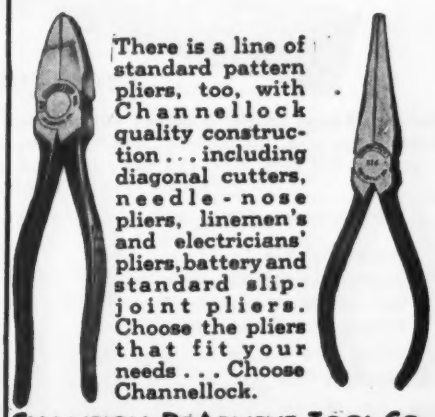

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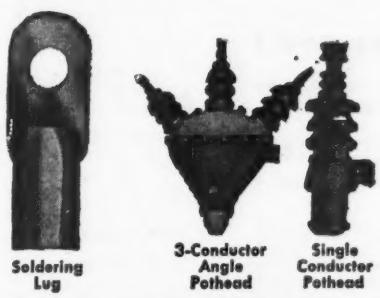

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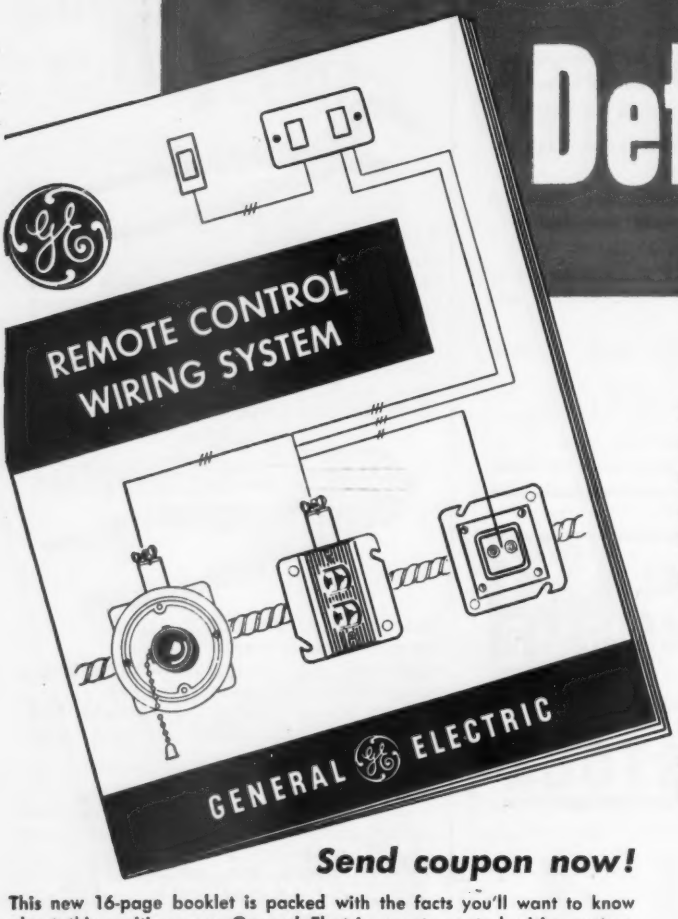

Explains All Components

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We suggest that you tear out the bottom card before you start reading the following pages. Keep the card handy. You might even use it as a book mark in case you are unable to complete reading the following pages at one sitting. Then, as you see some new products about which you want to know more, just circle on this card the number which appears at the top of the item describing the new product or catalog. Circle each number on this card which corresponds to the number on the item in which you are interested.

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ELECTRICAL CONSTRUCTION AND MAINTENANCE
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Please send me without obligation, the new product information or catalogs described on the following pages and identified by numbers circled below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136				

Advertising on page . . ☐ ☐ ☐ ☐ ☐

NAME..... TITLE.....

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want more information about a new product?

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want advice on a technical problem?

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Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

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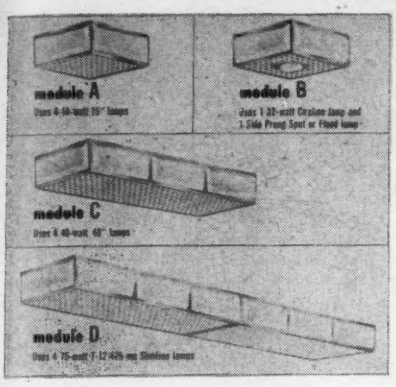
Product News



Modular Lighting System (1)

A new modular lighting system, called the Mitchell Module, has been announced. Basically, the new system consists of four units, with a single or multiple standard measurement of 16¼ inches. They can be put together in combinations to fit a great variety of commercial lighting needs. Module "A" is 16¼ in. by 16¼ in. It uses four 14 watt T-12, 15 in. type F lamps. Module "B" is also 16¼ in. by 16¼ in. It uses one 32 watt 12 in. diameter Circline lamp and 1 Par/3SP spot or 1 Par/3FL lamp. Module "C" is 48¾ in. by 16¼ in. It uses four 40 watt T-12 48 in. type F lamps. Module "D" is 97½ in. by 16¼ in. It uses four 75 watt T-12, 424 milliamp slimline lamps.

Six advantages claimed for the modular principle are (1) it provides fluorescent lighting "building blocks" that can be used not only individually or in continuous rows, but in 90 degree patterns. (2) Module is adaptable to the architecture of any room area, regardless of shape or size. (3) It offers a uniform lighting system in graduated lengths based on the single unit size of 16¼ in. (4) It permits the combination in one lighting system several popular commercial light sources: Type F fluorescent lamps, slimline, circline, and spot or floodlight incandescent lamps. (5) It produces equal low brightness on all sides and ends. (6) Module provides matching units of different sizes for different interiors.

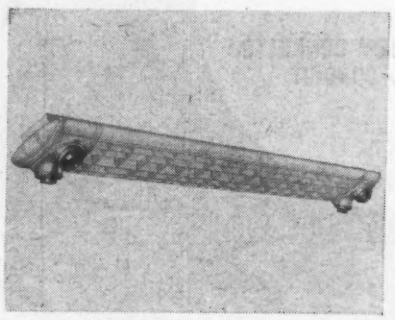
Development of a new clamp connector makes it possible to add Modules easily and quickly to existing patterns. Units fit together both mechanically and electrically. A Module design kit has been developed to aid in planning and installation. Patterns can be worked out simply on a modular grid to fit the particular ceiling area. *Mitchell Manufacturing Company, 2525 Clybourn Street, Chicago, Ill.*

Panelboard (2)

The Pushmatic service electri-center, recently introduced, features a new kind of control and protection for homes, commercial buildings, garages, and manufacturing plants. Smaller than ordinary load centers, the panelboard, by using compact Pushmatic units, contains more wiring space. Pushmatic makes or breaks circuits with a push of the finger. If power is broken by short or overload, service is restored with the same push operation. Available in 2, 4 and 8 unit cabinets, the service electri-Center and pushmatic carry Underwriters' approval. *BullDog Electric Products Company, Roosevelt Park Annex, Detroit 32, Mich.*

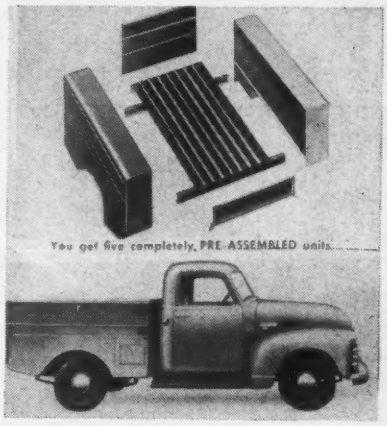
Outlet Box (3)

A new shallow surface wiring outlet box, No. 5020, has been developed. It is 1⅜ inches high. Working parts protected from dust and moisture by two insulating housings. For use with Nos. 12 and 14 non-metallic sheathed cable. It is designed for use in farm buildings, garages, attics, basements, etc. It is listed by Underwriters' Laboratories, Inc. and approved by REA. *Union Insulating Co., Inc., Parkersburg, W. Va.*



(4)

EIGHT-FOOT SLIMLINE ***luminaire with matching spotlight sections styled to blend in design with fluorescent assemblies features instant start starterless operation. This "Merchandiser" unit utilizes four 8-foot slimline lamps, has a one-piece housing entirely free of electrical parts and can easily be held in position for ceiling surface mounting. Top reflector assembly contains completely wired ballasts and lamp holders. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.***



Truck Body (5)

Knocked-down truck bodies ready for assembly are designed for mounting on any late model half-ton chassis and, by following assembly instructions, can be installed in approximately 4 hours. Of all-steel construction and electrically welded, body has large side compartments for carrying tools and materials. All compartment doors are weather tight and are equipped with locks. Body floor is of pressed steel. In case of damage, every section is replaceable as a unit and optional extra equipment is also available, including overhead ladder racks, tarpaulin for covering bulk loading space, electric meter trays and utility extension ladders. Body weighs 495 pounds uncrated and measures 75 inches in length, 29 inches in height, 46.5 inches in width (inside) and 72 inches wide (outside overall).

Artisan Products, Inc., 3540 West 140th St., Cleveland 11, Ohio.

Battery Charger (6)

A new type battery charger, known as Charg-O-Matic, for electrical industrial trucks has been announced. It is a fully automatic motor-generator type, single circuit battery charger requiring no base, bench or stand. Operation is simplified—insert the charging plug in the battery receptacle and turn one switch. All controls are at desk height for easy reading and operation. An electrically driven selective time clock switch provides automatic cut-off at end of charging period. It will charge one lead-acid battery in eight hours or less and one nickel-alkaline battery in seven hours or less. *Hertner Electric Company, 12690 Elmwood Ave. N. W., Cleveland, Ohio.*

Cat. No. 450 SET SCREW CONNECTOR
FOR THIN WALL CONDUIT

MW

Modern Fittings for

• thinwall conduit • rigid conduit • metallic and non-metallic cable • flexible steel conduit • service entrance cable • grounding devices • lighting fixture fittings

manufacturers for over 30 years

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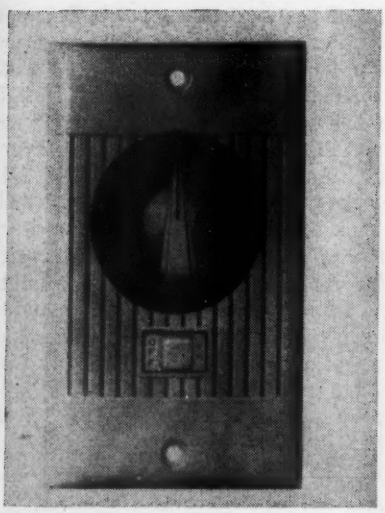
1639 walnut street chicago 12, ill.

Centrifugal Switch (7)

Pilot circuit switches for machine tools, conveyors, fans and motors can be obtained in six different models to suit a wide variety of industrial applications. Controlled by centrifugal force, contacts are opened and closed by changes in speed, making them applicable for dynamic braking, overspeed and underspeed protection, nonplugging and motor interlocking. Available with any standard contact arrangement and with dust-tight and oil-tight enclosures for surface or flange mounting, these units operate between limits of 125- and 3600-rpm. Switches with normally closed contacts are used as overspeed controls for motors, fans, belt conveyors and similar equipment.

The Euclid Electric and Manufacturing Co., Madison, Ohio.



Control Equipment (8)

A new selector switch control and a re-designed master control contactor for use with Square D's 24 volt lighting control system, has been introduced. Selector switch consists of a multi-pole, rotating type switch mounted on a single-gang switch plate, and includes one single-station, lever operated, "Off" and "On" switch. Rotating member is a two circuit, nine station, manually operated device, and can be used for selective control as well as master control. Master control contactor consists of two stationary contacting disks mounted on one frame. Movable contact arms are driven by one 24 volt 60 cycle motor geared to operate at approximately 15 rpm. No additional or special transformer is required for master contactors. *Square D Company,* 6060 *Rivird St., Detroit* 11, *Mich.*

(9)

MOGUL BASE LAMPHOLDER, ***for use with reflector type mogul base 300-500-watt lamps, is cast aluminum and comes completely wired with asbestos covered stranded wire leads through a weatherproof articulated joint. Feature is silicone heat resistant gasket, sealed at base of lamp neck, which will not weld or freeze under any operating heat conditions. Listed by UL, these Steberlites can be used singly, mounted in clusters of 5 or used in combination with medium base units. Steber Manufacturing Co., Broadview, Ill.***

Capacitor (10)

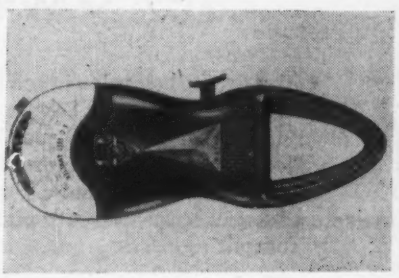
A new 3 kvar pole type secondary capacitor has been introduced. Rated at 240 VAC, 60 cycles, single phase, this capacitor is housed in a single container which not only is weather-resistant but also affords heat dissipation. Size is 8 inches wide by 13 inches long by 4½ inches deep. Some of the advantages are built-in discharge resistors, which remove residual charge hazards; fuse links within each hermetically sealed unit. *Cornell-Dubilier Electric Corp., South Plainfield, N. J.*

Switch (11)

An improved Dyna-switch used to protect hoists or cranes from accidental overloads has been developed. It slips on to the hoist or crane hook, and the load is lifted directly beneath it. The "U" shaped tool steel bar of the switch opens and closes the circuit of a microswitch as loads are lifted. If the hoist capacity is exceeded, the circuit automatically opens cutting out the motor and thereby preventing the operator from making the lift. Circuit remains open until operator presses switch to reverse. Hoist motors up to ¾ hp. can be handled by Dyna-Switch, and all higher capacities are worked through an intermediate relay. *W. C. Dillon & Company, Inc.,* 5410 *West Harrison Street, Chicago* 44, *Ill.*

Switch (12)

A new weatherproof, externally operated switch has been added to this line. Device was primarily designed for outdoor use on buildings requiring a 30 amp. capacity service entrance switch in combination with four plug fuse branch circuits. Two styles are available, R33NP4 with two main plug fuses and R33NU4 without provision for main fuses. Both types are equipped with a 1 inch hub. Raintight cabinet protects the interior mechanism so that switch has many applications for either temporary or permanent outside installations such as residences, athletic fields, parking lots, open air theatres and for branch lighting at fairs and carnivals. Access door for branch circuit lighting fuses provides dead front. Dead front cover is hinged at top and is provided with means for holding cover in open position to facilitate wiring and replacement of main fuses. Spring catch front cover can be sealed to prevent tampering with main fuses. *General Switch Corp.,* 45 *Roebling St., Brooklyn* 11, *N. Y.*



Instrument (13)

This new pocket type instrument, caled Amprobe, measures current without interrupting service. A plastic finger trigger opens the transformer probes and clamps around the conductor, thus measuring current in that circuit. To measure voltage a pair of test leads are inserted into the front-mounted pin-jacks and connected to line. Designed as a pocket instrument for the electrician, motor repair shops and maintenance men, the Amprobe measures 7⅛ in. long by 2 5/16 in. wide by 1⅛ in. thick. It is available in two models, each with seven ranges. Model A-5 is 6.5/13/26/65/130 amp. and 130/260 volts. Model A-6 is 10/25/50/198/250 amps. and 150/600 volts. Device is completely insulated. Jaws are specially shaped to get into tight spots, behind switch panels, motors and so forth. *Pyramid Instrument Company* 49 *Howard Street, New York.*

(CONTINUED ON NEXT PAGE)

NAME YOUR TAPE and
get more for your money...

PANTHER or DRAGON
by Okonite...

• You get the best value in commercial tapes today when you ask for Panther or Dragon. The reason you can depend on Panther and Dragon Tapes on all points is this: They're made by Okonite. 70 years of experience in manufacturing insulated wires and cables for every type of service testifies that Okonite knows how to make tapes for splicing cables.

The freshness you want in tape is tightly *sealed* in cellophane in every PANTHER and DRAGON package. And these tapes stay fresh in use because selected materials are carefully formulated to provide good working qualities indefinitely.

In addition you get . . .

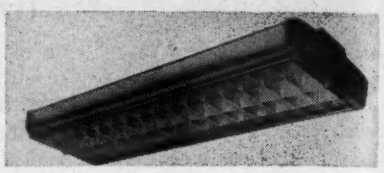
- Good all-around workability.
- Reliability in every splice.
- Guaranteed footage as stated on the package.
- Mechanical and electrical properties that surpass ASTM and Federal Specifications.

Better tapes come in packages labeled Panther and Dragon. Sold only through recognized wholesalers. Made by The Okonite Company, Passaic, N. J. 7006

Ask for them by name...

Panther and Dragon

friction and rubber tapes



(14)

COMMERCIAL LIGHTING *with 4-lamp 40-watt fluorescent units (matching the 2-lamp C-247 series) includes an unshielded, louver-shielded and plastic-shielded fixture. With distribution 37 percent up and 63 percent down, the unshielded unit is recommended for high bay stores, banks, public buildings. Shielded units are designed for offices, classrooms, stores and work areas requiring diffuse lighting. Basic chassis provides easy conversion. Sylvania Electric Products, Inc., 500 Fifth Ave., New York.*

Reflector Flood Lamp (15)

A new 300 watt, R-40 bulb, special service reflector flood lamp with a mogul screw base has been announced. The new lamp is an extension of the line of heat-resistant glass bulb lamps that includes a similar medium screw base lamp and the 75 and 150 watt PAR-38 bulb lamps. Rated at 115, 120 or 125 volts, the lamp has a maximum over-all length of 7¼ inches. Its average life rating is 1,000 hours. The ability of the heat-resistant glass bulb lamps to resist breakage on contact with water makes them especially suitable for a multitude of outdoor lighting applications such as the floodlighting of gardens, farm yards, service stations, industrial areas, used car lots and others. *Lamp Division, Westinghouse Electric Corporation, Bloomfield, N. J.*

Metal-clad Switchgear (16)

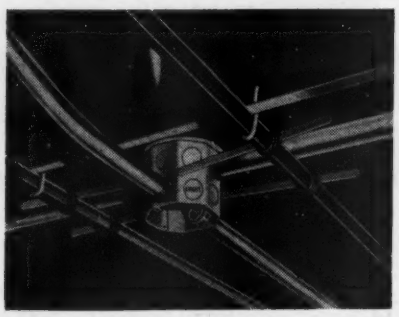
The new design of the outdoor type vertical-lift, metal-clad switchgear provides better protection against weather, improved ventilation, increased accessibility, additional compartmentation, more space facilities for auxiliary equipment, and greater safety. Welded-in steel floor plates with removable covers for incoming primary and secondary cables are incorporated. Door handles have ice and sleet shields for protecting locks and hasps for padlocking the units. Circuit breakers are now withdrawn from rear. Air circuit breakers are individually equipped with wheels. Width of each unit has been increased. Adequate heating and lighting facilities are provided in the front and rear of each unit. Receptacles for power tools, trouble lamps, etc, are included. *Allis-Chalmers Mfg. Co., Milwaukee, Wis.*

Fluorescent Lamp (17)

Announcement has been made of a fluorescent lamp that operates without the need for an external reactor or ballast. This lamp appears almost identical to the old type but it incorporates within the glass tube itself, a special resistance that eliminates the need for any external ballasting. Lamp uses standard fluorescent starters and the sockets into which the lamps fit are similar to other sockets except that they are polarized to assure lamp being correctly inserted. *Solar Electric Corporation, Warren, Pa.*

Lighting Fixture (18)

A new combination fluorescent-incandescent fixture primarily for use in the kitchen, but adaptable to a wide variety of residential and commercial lighting uses has been announced. Known as Dualite, it is equipped for use with standard 12 inch diameter 32 watt circline fluorescent lamp in combination with a 100 watt silver bowl incandescent lamp, which furnishes illumination indirectly from the high-gloss reflecting surface. *Guardian Light Company,* 301 *Lake St., Oak Park, Ill.*



Hung Ceiling Box (19)

The Knight-patented hung ceiling box is designed particularly for use with suspended ceiling type of building construction. Unit consists of box, which has been slotted for insertion of two parallel bars along which box may be moved for adjustment to desired position. Box is then automatically locked in place by slight outward expansion of bars which are then tightly fastened to supporting framework. Box bars are mounted on channels which are tied to cross members suspended from concrete beams above. Box is fitted with an upper row of knockouts which permits conduit to enter over grid structure at eight different angles, and a lower row which permits conduit to run parallel with channels. *M. B. Austin Company, Northbrook, Ill.*

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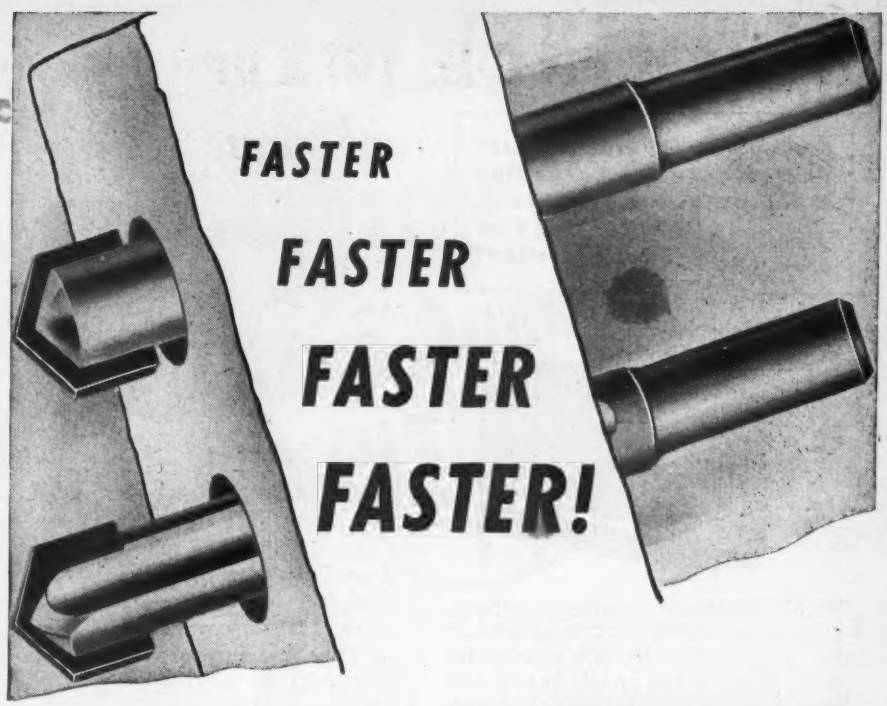
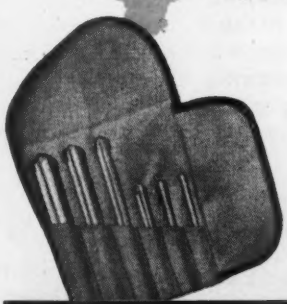


NOW... DRILL MASONRY UP TO 4 TIMES FASTER!

- Two styles (fluted or round shrank) for deep or shallow holes
- Wide range of sizes
- Carboloy Cemented Carbide tips drill any masonry
- Drills stay sharp up to 50 times longer
- Fit any standard rotary drill press, or hand brace
- Drill clean, accurate holes . . . quietly
- Available singly or in 3 handy kits of six assorted sizes each



No wonder these rotary drills work so fast, stand up so long. The tips are made of Carboloy Cemented Carbide—the hardest metal made by man!

Send the coupon for more information about these time- and money-saving drills, and about the three handy assortments.

CARBOLOY® CEMENTED CARBIDE MASONRY DRILLS

CARBOLOY CO., INC., 11175 E. 8 Mile Blvd.
Detroit 32, Michigan

Gentlemen:

Please send me free Folder SA 236, containing prices and specifications on Carboloy Masonry Drills.

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NEW LINE!

Famous Oster "Pipe Master" Portable Power Threading Machine Now Available in FOUR MODELS for your Selection!

World-wide experience with the performance of the Oster No. 502 ***"Pipe Master"*** for many years built up a demand for wider applications of this highly successful portable pipe threading machine.

Oster engineers accepted that challenge and developed FOUR ***"Pipe Masters"*** . . . three new machines and an advanced model of the original ***"Pipe Master"***.

The New "Pipe Master" Line

No. 522 DE LUXE. Aluminum alloy construction for lighter weight with extra rigidity and durability. Stationary Die-head (the pipe turns in the fixed die-head).

No. 552 DE LUXE ROTARY. Aluminum alloy construction. ROTARY Die-Head and Open Type Vise. (This principle makes it easy to thread BENT pipe in addition to straight stock.)

No. 502 STANDARD. This is the Improved ***"Pipe Master"*** with stationary die-head. Steel construction.

No. 532 STANDARD ROTARY. Adapted from the No. 502 model but equipped with ROTARY Die-Head and Open Type Vise for threading BENT and straight stock. Steel construction.

Range of Machines

All four ***"Pipe Masters"*** have a standard range of ¼" to 2" pipe and extra range of ⅛" pipe. Nos. 522 DE LUXE and 502 STANDARD ***"Pipe Masters"*** have extended range of 2½" to 8" pipe when used with Oster universal drive shaft to drive geared receding die-stocks.

• • •

Now, with these FOUR ***"Pipe Masters"***, you can select the ONE model that meets YOUR individual needs exactly! Write for the new ***"Pipe Master"*** catalog.

OSTER

THE OSTER MANUFACTURING CO.
2081 EAST 61st STREET
CLEVELAND 3, OHIO, U. S. A.

Safety Switches (20)

Announcement has been made of three new lines of safety switches—Type A, heavy duty industrial service; Type C, standard duty industrial service; and Type D, general purpose service. A full cover interlock feature on Type A switches has an attachment that locks the switch "on" or "off"—the cover can be closed with 1, 2, 3 or 4 padlocks of nearly any size and shape. Current carrying parts are silver plated, and blades are visible for quick checking of switch operation. Line terminals are dead front, protected by hinged arc chamber cover. There is a magnetic plate in the arc chamber cover. Jaws and fuse clips are steel reinforced. Non-tracking insulation is used in base. Insulating cross bar is formed of melamine. Pressure connectors are removable. Types C and D are similar in appearance and dimensions to Type A, with design and construction details differing to meet service demands. Available in 30 and 60 ampere sizes. *Square D Company, 6060 Rivard Street, Detroit 11, Mich.*

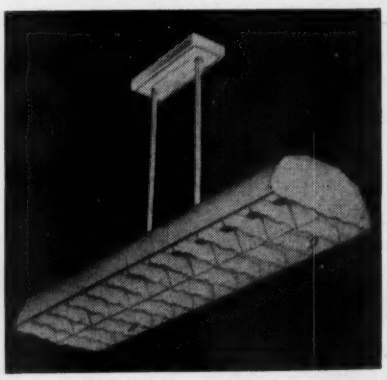
Inter-Office Phone System (21)

Inter-office communication instruments which permit two-way conversations without use of push-to-talk key, leaving hands free for other duties, have been developed. Designed primarily for executives and staff members, the name of the caller lights up on executive's instrument, leaving him free to refuse the call, if he is busy, and pick it up later. No one can cut in on the executive but he can link himself with his staff when desired without eavesdropping, even when they are conversing with each other. This is done by means of a light signal on each staff station, which indicates to the staff member who is called, that his conversation should be terminated quickly as the boss is trying to call him. Equipment is interconnected so that any staff member can converse with any other.

Modern Telephone Corporation, 509 Madison Ave., New York 22, N. Y.

Brake & Control (22)

A new d-c two-shoe, two-magnet brake and a new d-c crane hoist control, have been announced. Brake is designed for use on steel mill drives, cranes, hoists, bridges, conveyors, and for general marine service. Control is specially intended for use on whirley, revolver, gantry, and overhead cranes in steel mills, shipyards, on ore bridges, warehouses, and on loading and unloading towers. Brake consists of a malleable iron frame, two self-aligning shoes which pivot on spherical bearings, two armatures pivoting on sealed graphite bearings, two symmetrical E-type magnets with cast-in coils, and a ventilated wheel of molybdenum alloy. Brake is applicable for either right or left hand mounting, either on floor or, with brackets, on motors. Crane hoist control provides power hoisting and power dynamic lowering, depending upon requirements of load on hook. *General Electric Company, Schenectady, N. Y.*



(23)

LOUVERED FIXTURE, ***all-steel, the L-I-N-O-L-I-T-E Series 27, is available for two 40-watt T-12 fluorescent lamps, has a distribution of 40-percent upwards and 60-percent downward, produces concentration of 1800 lumens in critical working zone between zero and 60 degrees. With louvers held by loop clips and catches, unit can be mounted singly or as continuous run directly on ceiling or stem suspended. Frink Corporation, 27-01 Bridge Plaza North, Long Island City 1, N. Y.***

Heavy Duty Bells (24)

The new No. 340 vibrating a-c adaptabels have been announced. Available in 4-, 6- and 10-inch sizes, these heavy duty bells can be used individually or in signaling or protective systems. They can be surface mounted or installed on any type of fitting. The adaptabels are Underwriters listed for indoor use and can also be used as weatherproof units when installed with gasketed back boxes. *Edwards Company, Norwalk, Conn.*

CONTINUED ON PAGE 170

HERE'S THE NEW...

WESTON A-C Clamp-Ammeter and VOLTMETER

5 Current ranges to 1000 Amperes

3 Voltage ranges to 700 Volts

Voltage terminals recessed, with insulated screw-type connectors on leads.

Heavily insulated jaws accommodate conductors to 2" dia. (bare or insulated).

Pointer stop for indicating motor starting currents.

Trigger operation for convenience.

Ask your Weston representative for full particulars, or write . . . WESTON Electrical Instrument Corp., 617 Frelinghuysen Ave., Newark 5, N. J.

WESTON *Instruments*

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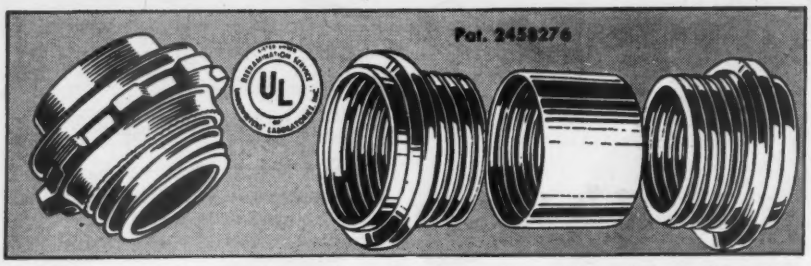
Try Them Just ONCE... Discover Why Contractors and Electricians Say "TOMIC'S CONNECTORS and COUPLINGS ARE THE BEST IN THE BUSINESS!"



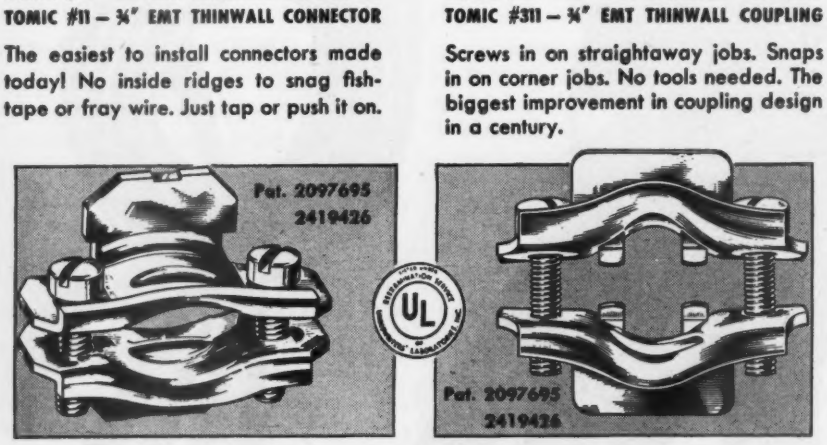
Tomic EMT connectors and couplings outmode all previous designs. No crimp, no screw, no wrench . . . just tap or push them on! Interior stainless steel lock washer assures you of positive ground. Will never shake loose! OK in concrete.

TOMIC #10 – ½" EMT THINWALL CONNECTOR
TOMIC #11 – ¾" EMT THINWALL CONNECTOR

The easiest to install connectors made today! No inside ridges to snag fish-tape or fray wire. Just tap or push it on.

TOMIC #310 – ½" EMT THINWALL COUPLING
TOMIC #311 – ¾" EMT THINWALL COUPLING

Screws in on straightaway jobs. Snaps in on corner jobs. No tools needed. The biggest improvement in coupling design in a century.



Tomic cable connectors are installed from outside of box. Slip cable through—flip screws tight and the job is done. Exclusive locking feature holds connector securely!

TOMIC #100 AND #200 CABLE CONNECTORS

No. 100 Romex connector for ½" K.O. (old or new type cable.)

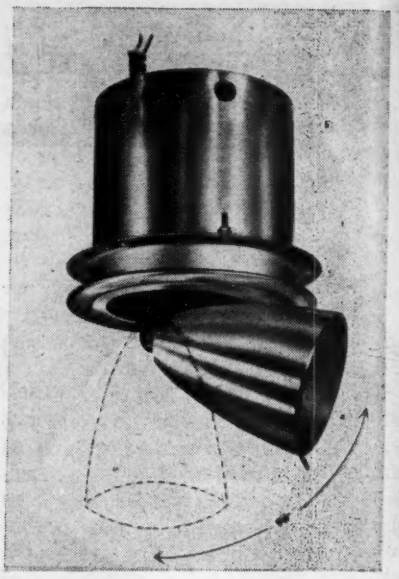
No. 200 Service entrance and range connector for ¾" K.O.

TOMIC #333 BX ARMORED CABLE CONNECTOR

For ½" K.O. and ⅜" Greenfield. Holds cable tight as a clam. No locknuts to lose.

On Sale At Better Jobbers Everywhere

Tomic Sales & Engineering Co.
4864 Woodward Ave. · Detroit 1, Michigan



(25)

GYRO-LITE *recessed lighting unit has vertical adjustment of 90 degrees, horizontal adjustment for full 360 degrees, can be mounted flush in ceiling wall or floor and can be equipped with lens and louvers for highlighting displays with a shielded light source. Swivelier Company, Inc., 30 Irving Place, N. Y. 3, N. Y.*

Speed Drive (26)

Announcement has been made of Mot-O-Trol packaged adjustable speed drive, employing electronic precision to provide a wide, stepless range of speed control for d-c motors from a-c sources. It starts motors, brings them up to a pre-set speed, permits change of speed at any time, applies dynamic braking for stopping, and reverses motors. A feature of drive is the sub-assembly construction of unit. Complete sub-assemblies can be removed for easy maintenance. A single dial gives finger-tip control of motor throughout its entire speed range. Speed may be preset before motor is started, or it may be changed after motor has come up to speed. *Westinghouse Electric Corporation, Pittsburgh 30, Pa.*

Threading Machine (27)

Known as No. 522 deluxe "Pipe Master", this new threading machine of aluminum construction has a regular pipe range of ¼ in. to 2 in. pipe; extra range ⅛ in. pipe; extended range of 2½ in. to 8 in. pipe when used with drive shaft and geared die-stock; and a bolt range of ¼ in. to 1½ in. Designed for light socket connection, machine is furnished with a universal geared head motor and safety switch for operation on 110-volt either a-c

single phase or d-c. Front chuck, called "Spinfast," eliminates need of chuck wrench. Rear chuck is self-centering. Machine is furnished for bench use but can be furnished on either a steel stand with 16 in. plain wheels or on a pipe leg stand with tool tray. *Oster Manufacturing Company, 2034 East 61st Street, Cleveland 3, Ohio.*

Batteries (28)

A new line of motive power, diesel-starting, and railroad air conditioning and car lighting batteries, known as the "Z"-plate line, has been announced. A new and improved grid has been developed. All models of the "Kathanode" and "Thirty" types include the new grid, bringing the advantages of improved electrical characteristics to users of industrial storage batteries. New casting rates and new mold-temperature control techniques were developed reducing grid porosity from 85 to 90 percent and hence reduce vulnerability to sulphuric acid attack. *Gould Storage Battery Corporation, Trenton, N. J.*

Motors (29)

This new type "Slo-Speed" geared motor is of "Klosd-Tite" construction for atmospheres containing non-explosive dusts, vapors and injurious foreign materials. External fan forces cooling blasts of air over the streamlined case. Type FWFB is totally enclosed and includes such features as labyrinth seals, heavy duty ball bearings lubricated for life, and Herringbone rotor, with motor and gears combined in a balanced design from power intake to drive shaft. Motor can be mounted in any position without modification. *Sterling Electric Motors, Inc., Telegraph Rd. at Atlantic Blvd., Los Angeles 22, Calif.*

Cable Connector (30)

Announcement has been made of a new two-bolt cable connector with helical serrations on the wire bearing surfaces. This feature increases the gripping ability of the clamp so that it will hold the strands of the cable securely. Clamp exerts a high pressure on cable and produces a low resistance joint. It is for inside or outdoor use. Approved by Underwriters for wire and cable sizes from No. 1 to 1000MCM. *Jasper Blackburn Products Corp., First, Madison and Clinton Sts., St. Louis 6, Mo.*

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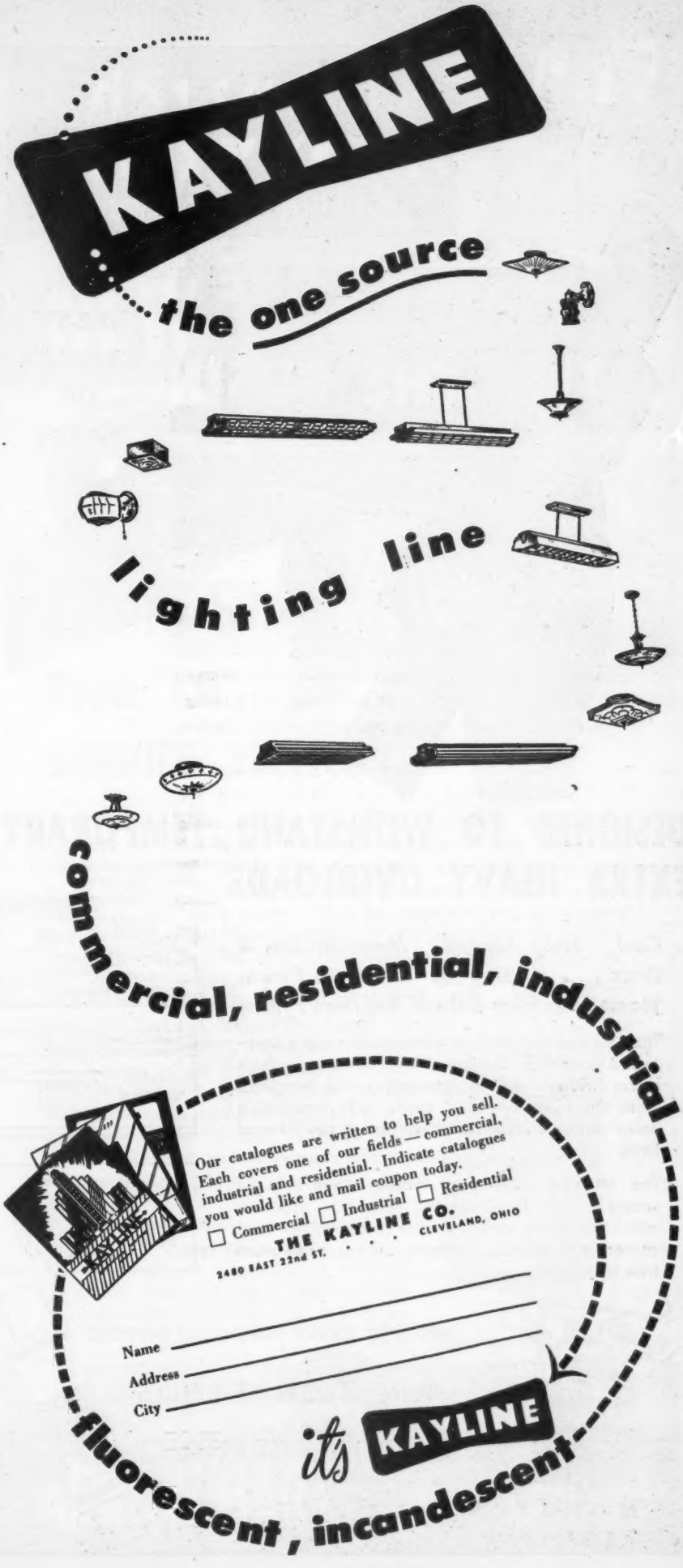
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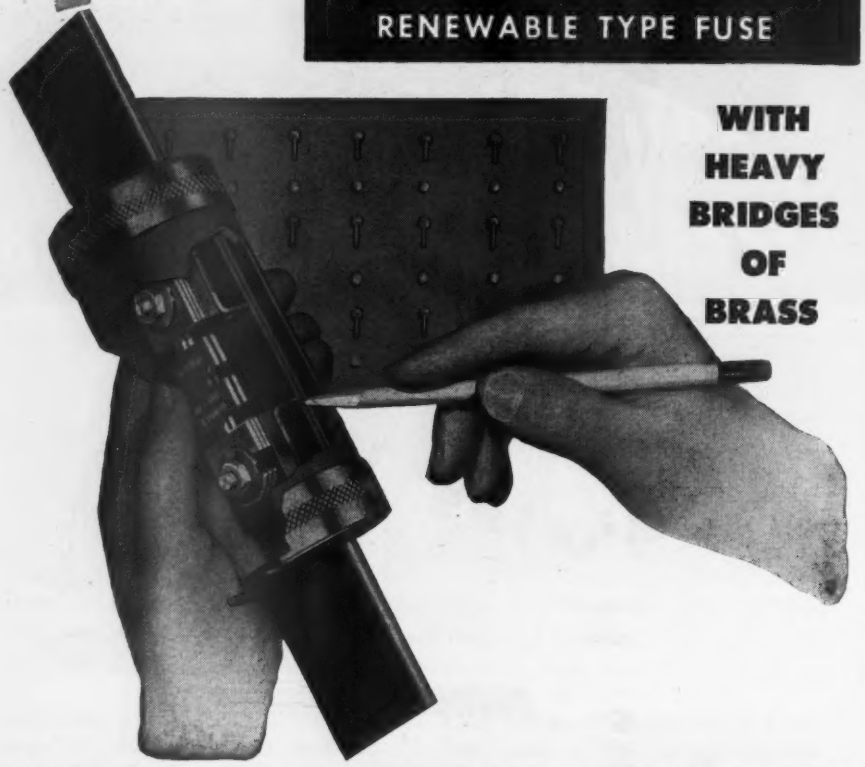
RENEWABLE TYPE FUSE



WITH HEAVY BRIDGES OF BRASS

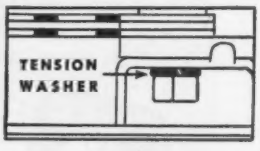
DESIGNED TO WITHSTAND TEMPORARY EXTRA HEAVY OVERLOADS

Approved by Underwriters Laboratory

Cool . . Truly Aligned . . Maximum Use of Brass . . . Adding up to Lower Power Waste Than Ever Before! And Here's How!

This new heavy duty fuse incorporates many time-tested Monarch features. The newest, — thick brass bridges widely separating the terminals from the fiber bar and made with ventilating holes—allow ***maximum dissipation of any internal heat.***

The Monarch method of locking these bridges securely to the terminals and fiber bar, together with Monarch's positive lock construction and compressed tension washers, insures ***permanent true alignment.***



Monarch RENEWABLE Fuses

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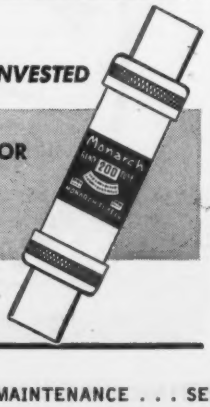

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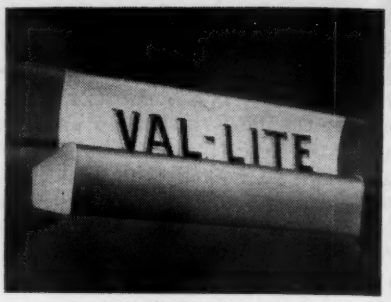


(31)

SIGN AND VALANCE LIGHT, *designed for advertising as well as for general illumination in retail stores, is available in standard models having two 40-watt fluorescent lamps for single or multiple unit continuous strip lighting applications. Letters are 6-inches high, are finished in contrasting Chinese red for high visibility and clip to fixture, making changing fast and easy. Fixtures are furnished with H.P.F. ballasts, sockets, starters and 6-foot rubber covered plug-in cord. Kent-Moore Organization, Inc. General Motors Bldg., Detroit 2, Mich.*

Door Operator (32)

Three sizes of fully automatic door operators, to open and close normally balanced doors and gates weighing up to 750 pounds and having areas up to 250 square feet, are available, complete with control switch and circuit, limit switches, motor and drive pulleys, V-belt, mounting brackets and bolts. Single or double doors, vertical lift or rolling units, folding partitions, skylights, stage curtains, windows or awnings can be opened, closed, or stopped at any desired point by utilizing any one of 10 different types of controllers. Rate of travel is one foot per second. Doors are automatically locked when closed, preventing theft or opening from outside by unauthorized persons.

Robot Appliances, Inc., 13165 *Prospect Ave., Dearborn, Mich.*

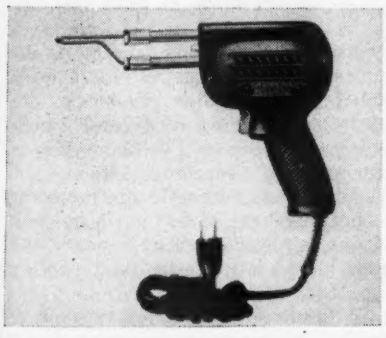
Slimline Lampholders (33)

A new set of "butt-on" type slimline lampholders for use with the 75 watt slimline fluorescent lamp has been announced. Available in black or white, they may also be used for slimline fluorescent lamps of the T-6 and T-8 size. Single-contact, high voltage end has an internal spring mounting which allows easy insertion and removal of lamp. Electrical connection is made to a terminal screw contact located in the opening at back. Enclosing the lampholder is a zinc-plated metal housing. Double-contact, low voltage end is also of the terminal screw type design, with a grooved face. It consists of a one-piece molded plastic unit, with the same mounting hole spacing

as the single-contact, high voltage end. Connected in series with the white primary lead, the low voltage and lampholder keeps primary circuit open until lamp is inserted in spring-end lampholder. Circuit is made alive only after lamp base pin makes connection with both metal contacts in lampholder. They carry UL approval. *Sylvania Electric Products, Inc., 500 Fifth Avenue, New York, N. Y.*

Gearshift Drive (34)

The new multispeed gearshift drive, identified as Type R4, is a self-contained unit combining an integrally mounted motor and a four speed transmission, and is designed to individually motorize machine tools formerly driven from lineshaft. It is also adaptable to many types of production equipment requiring selective speeds. Some of the features include a unit-cast gearbox; oil reservoir equipped with magnetic drain plug; conveniently located gearshift lever; motors and transmissions designed to withstand abuses. Four speed drives are furnished for operation on 2 or 3 phase, 25, 50 or 60 cycle, 220/440 or 550 volt a-c power supplies. Eight speed drives are designed to operate on 3 phase, 50 or 60 cycles, 220, 440 or 550 volts a-c and can be supplied with either constant-torque or constant-horsepower motors. *Lima Electric Motor Company, Lima, Ohio.*



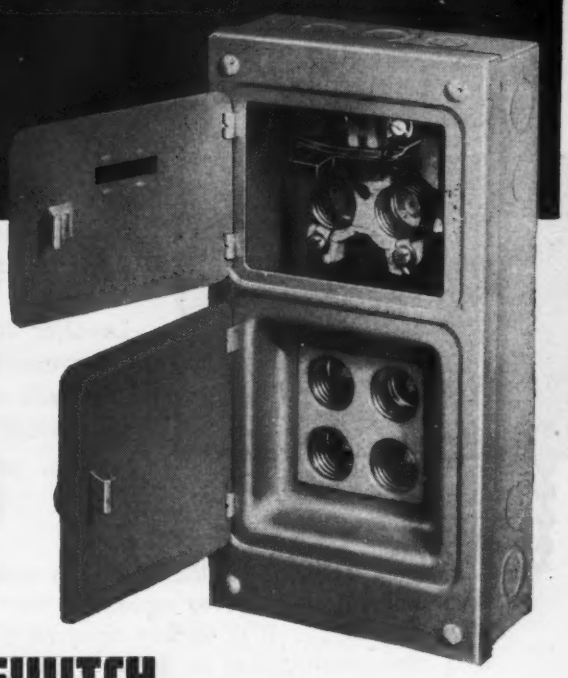
Soldering Gun (35)

A new heavy-duty soldering gun capable of handling 250 watts has been announced. Designated as Model WD-250, it is suited to all electrical, telephone, commercial and industrial soldering. Five second dual heat, prefocussed spotlight and new rigid-tip are included. Improved tip design provides more copper in chisel-shaped head with basic structure giving a bracing action. Streamlined design has terminals in an "over and under" position. *Weller Manufacturing Co., 808 Packer St., Easton, Pa.*

(CONTINUED ON NEXT PAGE)

SERVICE ENTRANCE EQUIPMENT

THE NEW



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27046-S

Type "CR"

SERVICE SWITCH

This new, popular Front-Operated Service Switch provides for two main and four branch circuits; fusible or no fuse mains. An economical unit for small homes — handles residential loads safely and dependably. Built for 125-250 volt service, this new "CR" is rated at 30 Amperes. Standard Type "CR" switch mechanism has a positive "ON" or "OFF" position; Bakelite handle; snug, full-floating bronze contacts; and handy terminals — just a few of many features that help build long, dependable service into the 27046-Line.

Another CURRENT Favorite-Type "CR" No. 27050

General Purpose, Front-Operated, 30 Ampere size for Plug Fuses and 30 and 60 Ampere sizes for Cartridge Fuses. Standard finish is gray enamel. In this switch, you have a unit as excellent in design and manufacture and as dependable as all other electrical equipment bearing our trademark. Ratings for 27050: 30 Amperes, 125-250 Volts A.C.

All equipment listed as standard by The Underwriters' Laboratories, Inc.

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for small space installations

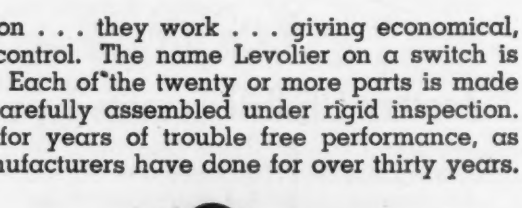
Switch space is often limited in modern, streamlined lighting canopies and fixtures, and FHP motor housings. However, by picking a Levolier Model 41 or 71, these units can have a reliable switch that will outperform and outlast most small switches two-to-one.

Model 41—6 amp. 125V. 3 amp. 250V. "T" Rated. ⅝" x 1⅜"

COMPACT, STURDY MODEL 41 has a single pole, double break mechanism, lever operated for positive control from any angle. It is widely adaptable for conduit box and canopy mounting for either incandescent or fluorescent lighting or FHP motors. Equipped with 6' cord with bell or plain lever. Standard finishes: brass, dark bronze or burnished nickel. Other finishes on special order.

ONLY McGILL MAKES Levolier SWITCHES

Push or pull in any direction . . . they work . . . giving economical, current saving individual control. The name Levolier on a switch is your guarantee of quality. Each of the twenty or more parts is made to precise standards and carefully assembled under rigid inspection. Choose Levolier switches for years of trouble free performance, as leading craftsmen and manufacturers have done for over thirty years.



MODEL 71 for installation where extra-thin switch is essential . . . 5/32" thick! (6 amp. 125V. "T" rated; 3 amp. 250V.) Easily installed with 6" wire leads which are permanently fastened to the terminals by pressure connections. Case is of molded phenolic plastic, with brass, dark bronze or burnished nickel lever. Complete with 6' cord and bell.

For the New McGill Catalog No. 49 write to McGill Manufacturing Co. Inc., Electrical Division, 450 N. Campbell Street, Valparaiso, Indiana.

AVAILABLE FROM YOUR ELECTRICAL WHOLESALER

Product Briefs

(36) H. R. Kirkland Co., Morristown, N. J., has announced a new line of "Super-Vize" lamp **annunciators.** (37) **Electronic towel** dries hands in 30 seconds without requiring any bodily contact; is made by Electronic Towel Corp., N. Y. C. . . . (38) General Electric, Schenectady, N. Y., announces improved line of 2½-inch panel **instruments** for apparatus with limited mounting space. . . . (39) Fluorescent lighting **power factor correction** to approximately 85 percent is possible with compact unit made by Aerovex Corp., New Bedford, Mass.

(40) New aluminum **vise stand** saves 50 percent weight and holds full line of pipe benders and threaders; is made by J. H. Williams & Co., Buffalo, N. Y. . . . (41) New 8-inch Guild **saw** weighs 13½ pounds, operates at various angles, also operates abrasive wheels, is manufactured by Porter-Cable Machine Co., Syracuse, N. Y. . . . (42) Spellman Television Co., Inc., N. Y. C., announces a compact, enclosed 30-kv RF **power supply** for use in dust precipitation, electrostatic painting and insulation breakdown tests.

(43) **Capacitors** for fractional horsepower electric motors are made by Cornell-Dubilier Electric Corp., South Plainfield, N. J. . . . (44) Instant-start 40-watt tulamp **ballast** for low temperature operation is anounced by General Electric Co., Schenectady, N. Y. . . . (45) Protection against shock and fire is provided by No-Shok safety **duplex receptacles** produced by the Bell Electric Co., Chicago, Ill.

(46) **Luminous safety signs,** called Brite-Glo and manufactured by the Western Luminous Safety Sign Co., Chicago, Ill., continue to glow for several hours after current failure; are recommended for exits, direction indicators and fire escapes. . . . (47) Ratchet type receding **die-stock,** designed for threading of 1- and 2-inch pipe is available from The Oster Manufacturing Co., Cleveland, Ohio. . . . (48) Flat stem magnetic **thermometer** for checking heat of flat surfaces such as irons, air ducts, exhaust ports and engine blocks is made by W. C. Dillon & Co., Inc., Chicago, Ill.

(49) Outdoor substation-type constant-current **regulator** for street lighting is announced by the General Electric Co., Schenectady, N. Y. . . . (50) Pressure sensitive electrical **insulating tapes** including cotton, rope, acetate, paper and film types are available from the Electrical Insulation Manufacturers Corp., Chicago, Ill. . . . (51) **Speed limiting devices,** made by Allis-Chalmers, Milwaukee, Wis., are adaptable to an extended speed range from 100 to 2000 rpm. when installed on motors, generators and m-g sets.

(52) Rubber-coated **fiberglas** in tape form, known as Silastic, is announced by the Irvington Varnish and Insulator Co., Irvington, N. J. . . . (53) **Humidifier** with 230-watt capacity evaporated 3 gph. without use of compressors,

piping or duct work, according to the Walton Laboratories, Irvington, N. J. . . . (54) New small cross-section **ballast** for 240-watt fluorescent lamps has been developed by the Advance Transformer Co., Chicago, Ill.

(55) **Brush stabilizing mechanism** for fractional hp. motors has been developed by General Electric Company engineers. . . . (56) The American Machine Works, Racine, Wis., announces a multiple jaw **wrench** for speeding the handling of pipes and solid rounds. . . . (57) Plastic safety **socket shields,** to fit over base plugs and electrical wall outlets, are manufactured by the Emeloid Co., Inc., Hillside, N. J.

(58) One piece plastic cap reduces wiring time; eliminates insulation stripping, according to Monowatt Inc., Providence, R. I., manufacturer of this Quick Clamp-On Cap for rubber, plastic or rayon-covered parallel **cords.** . . . (59) **Dial counter** for use in coil winding, reeling projects and punch press work has cast aluminum housing; can be mounted with flexible shaft or directly coupled to rotating shaft, says George Stevens Manufacturing Co., Chicago. . . . (60) Champion Lamp Works, Lynn, Mass., announces improved **fluorescent lamps** having average life of 7500 hours.

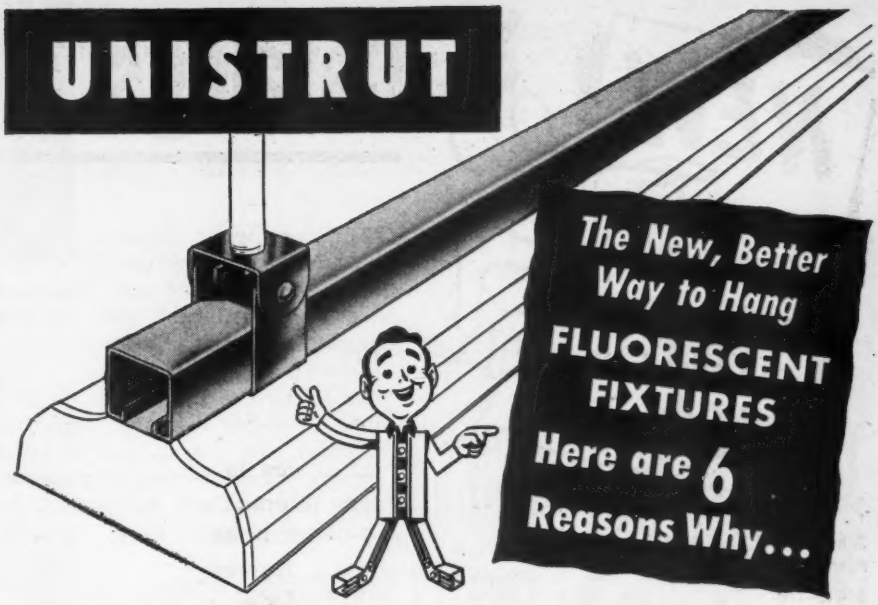
(61) Photoswitch, Inc., Cambridge, Mass., has produced a **photoelectric counter** including control, lighting source and counter in a packaged unit. . . . (62) Low-cost miniature Frahm resonant-reed **tachometer,** made by James G. Biddle Co., Philadelphia, Pa., accurately measures vpm. and rpm. between 1000 and 13,000 without contacting rotating elements.

(63) Wheelco Instruments Company, Chicago, Ill., has announced a new line of a-c and d-c measuring, indicating, signaling and recording **instruments.** . . . (64) A new all purpose **electrical box,** known as "Jay-Kay" has been introduced by All-Steel Equipment, Inc., Aurora, Ill. . . . (65) A new recessed **lighting unit** engineered especially for use with R-30, 75 watt reflector lamp has been announced by Litecraft Mfg. Co, Newark, N. J.

(66) Hugh B. Williams Manufacturing Co., Dallas, Texas, has announced a new **hole digger,** featuring raising, lowering and leveling of derrick hydraulically. . . . (67) New ceiling and outlet box bakelite **receptacles** have been announced by Eagle Electric Mfg. Co., Long Island City, N. Y.

(68) A small ceiling-pan **lighting fixture** approved for 60 watt bulb has been introduced by Lightolier, Jersey City, N. J. . . . (69) Lindell Electric Company, Minneapolis, Minn. has developed a new electric **drill boring attachment** for use on any half-inch electric drill. . . . (70) A new triple purpose, portable machine for cutting, reaming and **threading pipes** has been announced by Peerless Machine Company, Racine, Wis. . . . (71) Single-phase motors have the reversing characteristics of three phase motors when equipped with the new **Reverswitch** manufactured by the Iron Fireman Manufacturing Co., Portland, Ore.

UNISTRUT



1 Fewer Hanger Stems and Canopies

Unistrut's great channel strength permits wider spacing of stems—up to 15 ft. apart if desired, but a better appearing installation and obvious savings.

2 Perfect Alignment

Unistrut channel is rigid, strong and perfectly straight—gives you true alignment of fixtures. Cleaning, re-lamping or other servicing cannot disturb this alignment.

3 Completely Flexible

Stems or rods can be installed at *any* point along Unistrut channel to overcome possible ceiling irregularities or obstructions. Ideal for continuous runs or intermittent spacing of fixtures.

4 Faster, Easier Installation

Unistrut channel and fittings are attached to fixtures quickly and easily at normal working height or at suspension level. No drilling, no welding, 100% adjustable.

5 Added Safety

Unistrut assures the utmost safety of installation because an entire row of fixtures becomes a single integrated unit—added safety obtained by no other method.

6 Saves Time and Money

Reduces number of canopy and stem sets used, lowers wiring and rewiring costs, eliminates drilling and welding costs, saves planning and installation time.

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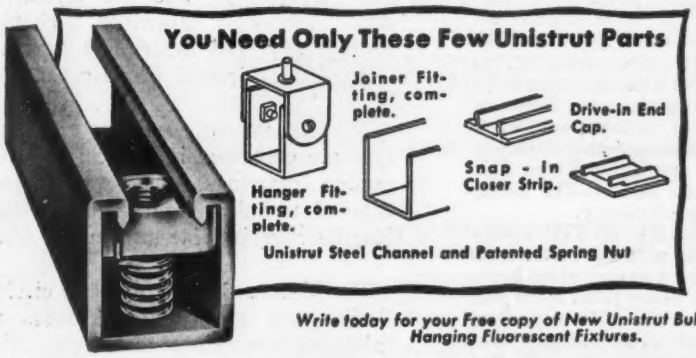
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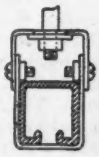
Drive-in End Cap.
Snap - In Closer Strip.
Hanger Fitting, complete.
Unistrut Steel Channel and Patented Spring Nut



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Pull the trigger switch and you solder. Release the trigger, and off goes the heat—automatically. No wasted time. No wasted current. No need to unplug the gun between jobs. 'Over and under' position of terminals provides greater visibility with built-in spotlight. Extra 5¼" length and new RIGID-TIP mean real soldering efficiency.

Chisel-shape RIGID-TIP offers more soldering area for faster heat transfer, and new design gives bracing action for heavy jobs. Here you get features not found in any other soldering tool . . . advantages that save hours and dollars. Your Weller Gun pays for itself in a few months. Order from your distributor or write for bulletin direct.

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Catalogs and Bulletins

(72) PUSHBUTTON SERVICE PANELS with automatic protection for electric circuits are discussed and illustrated in bulletins 493 and 494. Bulldog Electric Products Co.

(73) SELENIUM RECTIFIERS — Brochure C-349-848 discusses converting equipment for a-c to d-c operation contains characteristics, applications, circuit diagrams and design data. International Rectifier Corp.

(74) PLUG-IN-STRIP for work benches, offices, displays and residential applications is subject of catalog 598. National Electric Products Corp.

(75) SLIMLINE LUMINAIRES are presented with dimensions, prices, weights and design characteristics by The Miller Company.

(76) A-C MANUAL STARTERS of the across-the-line type are subject of file bulletin 3151. Ward Leonard Electric Co.

(77) BUS DUCT for secondary systems, including plug-in, feeder, low impedance and weatherproof types, is topic of booklet B-4271. Westinghouse Electric Corp.

(78) INSTRUMENT TRANSFORMERS of the butyl-molded line are discussed with sectional drawings, charts, photographs and descriptive text in GEA 5274. General Electric Co.

(79) RELAYS of mercury plunger type are contained in bulletin 48 with outline drawings, photographs and detailed technical information. Ebert Engineering and Manufacturing Co.

(80) MOTORS having "safety circle" design and construction features to minimize corrosion, distortion, friction and the entrance of foreign matter are detailed in bulletin 51B-621OB. Allie-Chalmers.

(81) ROOM HEATERS with automatic control, lifetime heating elements and fans is specified in form EC 58. Electromode Corp.

(82) PIPE TOOLS, power pipe machines, power drives and accessories are presented in 52-page catalog. Toledo Pipe Threading Machine Co.

(83) LIGHTING fixtures for residences and commercial locations, both fluorescent and incandescent, are presented in 2-color booklet introducing Lytron units by Lightolier.

(84) BLIND RIVETS for heater ducts, buses and similar applications are visually demonstrated in a "pull-tab" card containing description of design and uses. B. F. Goodrich.

(85) TRANSFORMERS with standard parts, having wide latitudes in voltages and accessories, are presented in catalog 1924. Pennsylvania Transformer Co.

(86) SLIMLINE fixtures with incandescent auxiliary spotlight assemblies, for institutional, commercial and industrial use, are presented in 2-fold 3-color pamphlet with detailed drawings and prices. The Kayline Co.

(87) REACTORS for generators, bus ties, station ties and feeders are pictured and specified in form 600. Murray Mfg. Corp.

(88) WOUND ROTOR MACHINES, with charts, specifications, photos and text, are subject of bulletin SR-1. Howell Electric Motors Co.

(89) PUMP CONTROL booklet, covering 37 pages with specialized data on domestic water systems, deep wells, compressors, cellar drains and standard sumps and tanks. Cutler-Hammer.

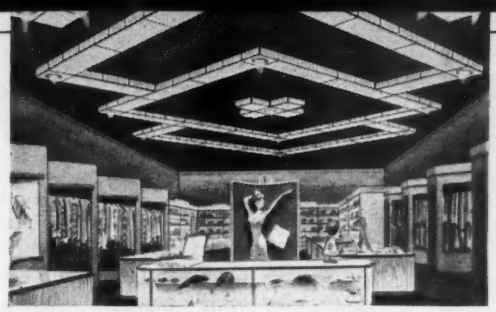
(90) CABINETS for main service, range and lighting are announced and discussed in 2-color bulletin 492. Bulldog Electric Products Co.

(91) OUTDOOR FLUORESCENT lighting data, with charts and construction details of Post-Lites, are contained in 4-page bulletin. W. H. Long Co.

(92) PLUGS, RECEPTACLES and cord connectors with automatic locking midget ever-lok features are diagrammed and specified in 12-page 2-color bulletin EL-49. Russell and Stoll Co., Inc.

(93) BATTERY CHARGING equipment for motor-generators is presented with photographs, drawings, technical data and specifications in bulletin 234. The Electric Products Co.

(CONTINUED ON PAGE 178)



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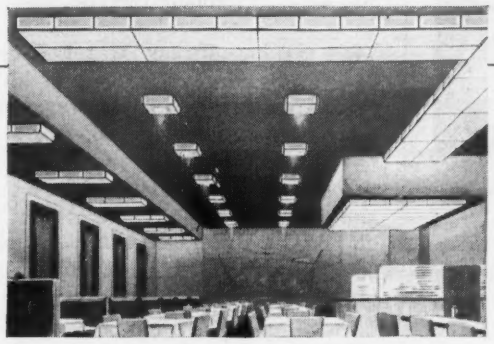

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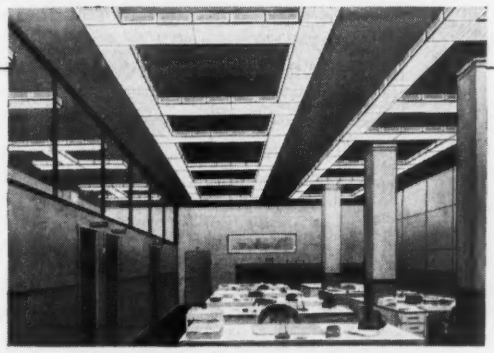

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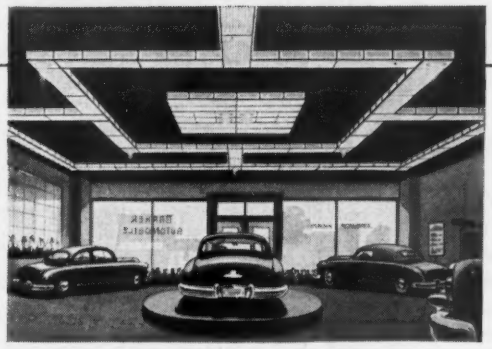

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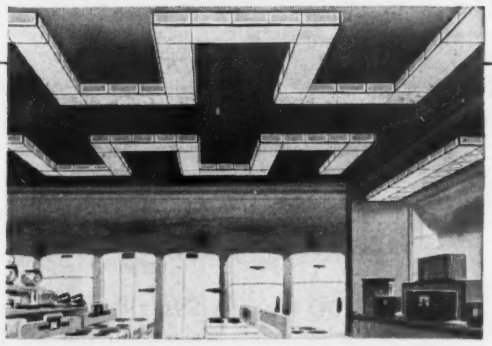
lighting system



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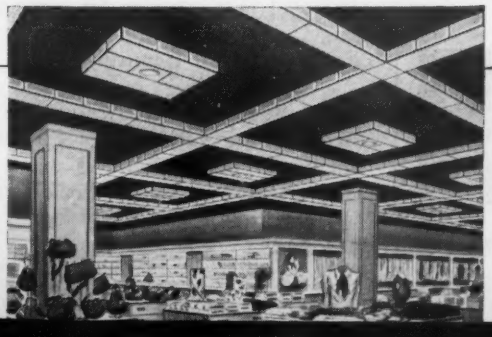

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If you know linemen, you know they want the finest in quality when it comes to equipment. Not only does their job depend on it—many times their lives do.

It is the reputation of nearly a century in designing and manufacturing the finest in linemen's equipment that has won Klein its position of preference with linemen and electricians everywhere.

It is easy to make equipment that looks like Kleins. It takes years of experience plus extensive manufacturing facilities to make equipment that performs like Kleins.

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(94) A-C Generators with capacities from 5 to 300-kw and speeds from 720 to 1800-rpm. are described in bulletins 3149 and 21749. Kato Engineering Co.

(95) Magnetic Motor Control for a-c motors up to 50-hp. is subject of 22-page 4-color bulletin containing full data. Trumbull Electric.

(96) Single Phase Motors, repulsion start induction brush lifting types, are specified and diagrammed in form 942. Century Electric Co.

(97) Oil Circuit Breakers for the protection of high voltage (69, 115 to 230-kv.) transmission equipment are presented in 8-page 2-color bulletin 71B6022C. Allis-Chalmers.

(98) Code Call Unit with pilot light, directory and selector dial is discussed and diagrammed in folder 4B. Wheelock Signal Engineering and Mfg. Co.

(99) Insulation Resistance testing and maintenance hints are contained in pocket-size booklet titled "For Practical Men". James G. Biddle Co.

(100) Welding Without Current by using the Cadweld Process is recommended for connecting copper to either steel or copper in 8-page bulletin containing photographs, specifications and text. The Electric Railway Improvement Co.

(101) Portable Cables and cords, neoprene jacketed, oil resistant, for heavy duty, grounding, welding, mining work and high voltage is subject of 32-page booklet. General Cable Corp.

(102) Battery Chargers for 6-cell lead acid batteries, with automatic adjustments, are discussed, priced and specified in file sheet bulletin 342. Baldor Electric Co.

(103) Truck Bodies of steel, for all transportation purposes, with accessory storage compartments, winches, etc., are sketched and described in bulletin B49-1A. Morrison Steel Products, Inc.

(104) Paging Systems for manufacturing plants and institutions are fully presented in a file-size kit containing charts and tables, photographs and prices. Autocall Company.

(105) Fuse Puller Switches to be used as residential panels for main, range and lighting circuit protection are presented in 4-page 2-color folder

TEC 311A. The Trumbull Electric Mfg. Co.

(106) HARDWARE such as expansion shields and bolts, calking and screw anchors, masonry drills, pipe clamps, cable supports and pole accessories are pictured, discussed and priced in catalog 49. Diamond Expansion Bolt Co., Inc.

(107) RECESSED LIGHTING UNIT, adjustable horizontally and vertically, is diagrammed and specified in file folder 126 titled Gyro-Lite. Swivelier Co., Inc.

(108) TRANSFORMERS for indoor and outdoor use are presented in 32-page booklet 61B7168, together with full data on potential transformers and metering outfits. Allis-Chalmers.

(109) PYROMETER CONTROLLERS — Panelmount capacitrol indicating pyrometer controllers of interchangeable unit construction are discussed in bulletin PC-1. Wheelco Instruments Co.

(110) WELDING ELECTRODES — Bulletin 462 includes guide for selection of electrodes designed for mild steel and low-alloy high-tensile steels. The Lincoln Electric Co.

(111) ELECTRONICS CATALOG — Engineering data on jacks, plugs, switches and similar products for radio and electronic work are included with line drawings, wiring circuits and prices. Switchcraft, Inc.

(112) ALUMINUM CABLE—Data book on aluminum ACSR and all-aluminum cable gives information on physical and electrical properties with tables, length and weights of cables, reel sizes, etc. Permanente Products Co.

(113) STAND-BY POWER PLANTS — Catalog 449-SB gives ratings and operating characteristics of 1800-rpm. air-cooled generators from 3000- to 15000-watts a-c capacities. Kato Engineering Co.

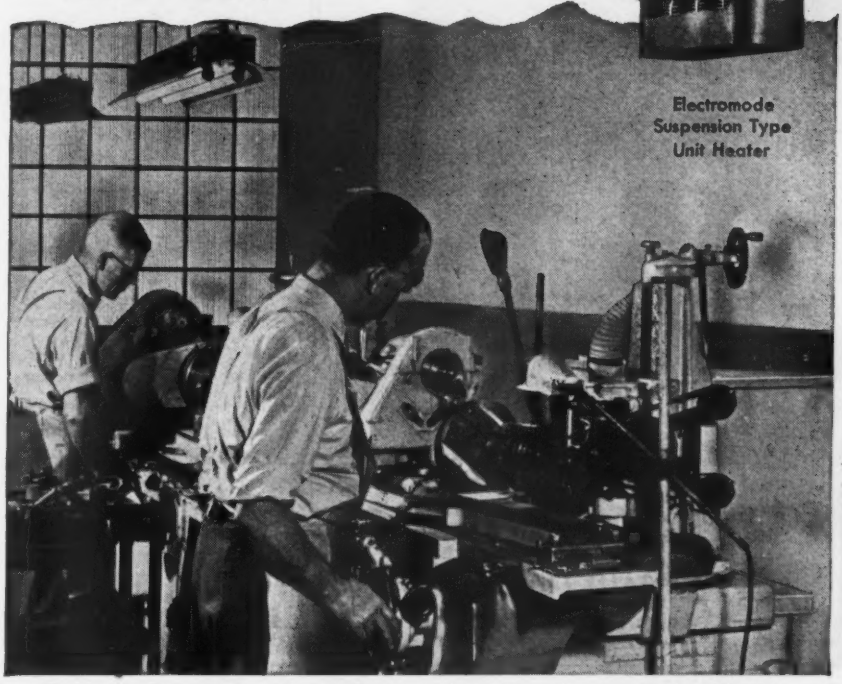
(114) FARM ELECTRIFICATION — Application of motors and controls to specific farm operations is contained in 15-page booklet 4155, "How to Apply Motors and Controls to Farm Jobs". Westinghouse Electric Corp.

(115) FLEX-A-POWER DISTRIBUTION —4-page circular shows 7 installations of flexible systems that can be dismantled, moved and reinstalled with complete salvage of materials. TEC-151. The Trumbull Electric Manufacturing Co.

(CONTINUED ON NEXT PAGE)

FOR SAFE, LIFETIME HEAT

There's Only One Answer—



ELECTROMODE

IN factories, shops, shipping rooms, guard houses, offices and locations isolated from the main heating system, Electromode Industrial Heaters are supplying safe, efficient, *lifetime* warmth, year after year. For only Electromodes have the patented heating element that *lasts a lifetime . . .* and *eliminates all danger of fire, shock or burn!*

Electromodes require no plumbing, no ductwork and practically no maintenance. Capacities from 1.5 to 45 KW. Portable and built-in-wall units also available for office or home. Approved by Underwriters' Laboratories. Contractors—see your electrical wholesaler or write Electromode for further information.

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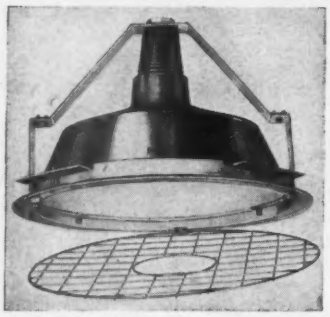
"HINDSIGHT IS BETTER THAN FORESIGHT"
NOT SO WITH THIS FIXTURE.
A SIGHT ON MAINTENANCE OF THIS UNIT
WILL CHANGE THIS WISE SAYING TO "FORESIGHT SPECIFIES MULTI-LITES"



CATALOG NO. 3088

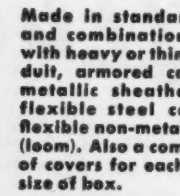
Servicing from above or below suspended ceiling is easy with this multi gymnasium fixture. Two thumb screws hold detachable saddle permitting reflector to be lifted up through plaster ring. Threaded neck of reflector permits easy removal from below. Catalog No. 3088 with hinged wire guard covers the entire unit illustrated. 300-500 watt reflector is heavy gauge steel porcelain enamel finish, white inside, green outside.

DISTRIBUTED THROUGH LEADING WHOLESALERS

MULTI ELECTRICAL MFG. CO.
4223-43 WEST LAKE ST. CHICAGO 24

A COMPLETE LINE OF AUSTIN OUTLET BOXES, CABLE BOXES, EXTENSION RINGS AND COVERS

Made in standard depths and combinations for use with heavy or thin wall conduit, armored cable, non-metallic sheathed cable, flexible steel conduit or flexible non-metallic tubing (loom). Also a complete line of covers for each type and size of box.



AUSTIN No. 9-O-½
4" Octagonal Outlet Box

AUSTIN No. 300-½
4" Square Outlet Box

AUSTIN No. 2-D-½
4-11/16" Square Outlet Box

AUSTIN No. 9NX
4" Cable Box

WRITE FOR INFORMATION AND PRICES ON ENTIRE BOX LINE

The M. B. Austin Company
NORTHBROOK, ILLINOIS

SOLD ONLY THROUGH WHOLESALERS

(116) INSULATION RESISTANCE—Bulletin 209 contains capacities and specifications of all models from 100 to 50,000 megohms of vibrotest models of insulation testing instruments. Associated Research, Inc.

(117) ENCLOSED SWITCHES—68-page catalog covers line of enclosed safety switches, service entrance equipment, panels for light and power with complete tables and many illustrations. General Switch Corp.

(118) EXPLOSION-PROOF HOSPITAL equipment is graphically illustrated and conveniently cataloged in bulletin 1051. Design, application and installation data is included. Appleton Electric Co.

(119) STEEL STUD DRIVER—Bulletin TA-17 describes velocity-power driver for inserting steel studs in concrete, steel and masonry. Mine Safety Appliances Co.

(120) PRODUCTS BULLETIN pictures and describes transformers of many types, fluorescent lamp ballasts and fuses. Jefferson Electric Co.

(121) UNISTRUT—Catalog 500 includes pictures, data and detailed information on how to frame, hang, support and mount wide variety of electrical equipment. Unistrut Products Corp.

(122) ASBESTOS INSULATED WIRE—Wires and cables designed for use in extremely hot locations or in atmospheres where corrosive fumes and fire hazards are present are fully presented in 34-page catalog 509. National Electric Products Corp.

(123) SWITCHES — 4-page brochure TEC-1 describes enclosed switch designed for residential, farm and commercial purposes. The Trumbull Electric Manufacturing Co.

(124) CONDUIT, WIRE and cable are specified in condensed catalog 49. Triangle Conduit and Cable Co., Inc.

(125) CONTROL DEVICES — Bulletin 100,000 includes complete line of rheostats, resistors, relays, motor starters, contactors, accessories and dimmers for industrial and commercial control applications. Ward Leonard Electric Co.

(126) INSERT ARRANGEMENTS—Desk chart shows half-scale layouts of 211 insert arrangements, with wire, contact and clearance data. Connectors are used in radio, radar, television, instrument, general electronic and electrical equipment wiring. Cannon Electric Development Co.

(127) SOLDERING GUN—Four models of soldering guns for light and heavy duty work are described in file sheet 620-7-49. Weller Manufacturing Co.

(128) FLUORESCENT FIXTURES — Single, two and four-lamp commercial, residential and industrial fixtures for fluorescent and slimline adaptation, with variety of louvers, diffusing panels and reflectors are presented in illustrated 16-page catalog. Stanley Electric Manufacturing Co.

(129) SILICONE GREASES—Properties, performance and uses for heat stable and oxidation resistant silicone lubricants, and instructions for using silicone grease in the bearings of electric motors are contained in Notes D-5 and D-6. Dow Corning Corp.

(130) GRAPHIC INSTRUMENTS—Speed recorders and indicators, recording ohmeters, time recorders, relays, long distance meters, pressure recorders and portable current transformers are illustrated and explained in a booklet titled "Solving Industrial Crimes—Case Number 37". The Esterline-Angus Co., Inc.

(131) CAPACITOR INFORMATION—Kilovars, power factor and voltage rise are computed quickly with pocket-size card containing simplified diagrams to illustrate basic formulas, GEN-22. General Electric Co.

(132) LARGE INDUCTION MOTORS—32-page presentation covers basic theory, operation, characterictics and applications and control of large induction motors. Electric Machinery Manufacturing Co.

(133) ACCENT LIGHTING—20 engineered designs adaptable to dramatic and overall lighting by using cone-shaped swiveling reflectors are presented in folder 31-F2. Gotham Lighting Corp.

(134) FARM ELECTRIFICATION—Complete line of wiring materials for all uses on the farm is described and illustrated in catalog 596. National Electric Products Corp.

(135) MOTOR CATALOG—All motors, gear reducers, bases and fans in the EMC line are described in 4-page illustrated catalog folder. Electric Motor Corp.

(136) FIBERGLAS ELECTRICAL INSULATION—36-page manual and catalog describes glass-base materials available for insulating wire, cable and electrical equipment of all types. Owens-Corning Fiberglas Corp.

Soldering Doesn't Cost Me A Cent

"Prest-O-Lite" 5-in-1 Outfit $22.50

Since I Changed to This Outfit

Here's the way I figure it. I used to pump, prime, and generate before I could start work. Now I just turn a valve and flick a lighter. I get full heat instantly and save 5 to 10 minutes every time I light up. That's worth money . . . enough to work my new "Prest-O-Lite" Outfit for 54 minutes on an average job! By the end of a day, time saved this way has paid for all the "Prest-O-Lite" Acetylene I've burned.

What's more, my 5-in-1 Outfit handles easily and always gives me the exact flame and heat I want. So jobs go faster, too. I figure this extra time saved pays for my solder and flux. This way, soldering doesn't cost me a cent!

Ask your Jobber or write for more details. The Linde Air Products Company, 30 East 42nd Street, New York 17, N. Y. In Canada: Dominion Oxygen Company, Limited, Toronto.

"Prest-O-Lite" is a registered trade-mark of a Unit of Union Carbide and Carbon Corporation.

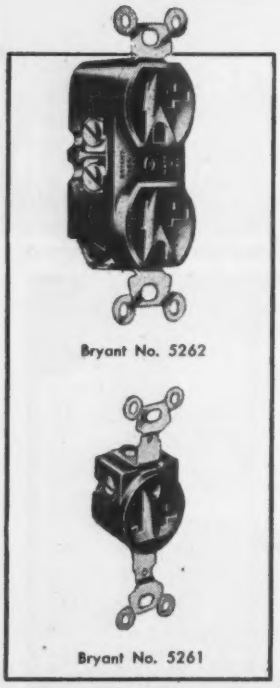
Order from your local Jobber

The Heavy-Duty "Badger"... A BETTER-BUILT Switch

• **All time switches are *not* alike. In the Reliance "Badger", arcing between contacts is eliminated, and objectionable sound level is reduced to a minimum. Extra heavy gears, a slow-speed synchronous motor, and heavy copper-to-copper, self-adjusting "floating" contacts—all help to make the Reliance "Badger", a better-built switch for long-lasting, accurate control. For complete information, write—RELIANCE AUTOMATIC LIGHTING CO., 1937 Mead Street, Racine, Wisconsin.**

RELIANCE TIME SWITCHES

WHEN THE PROBLEM IS CONTROLLING "JUICE ON THE LOOSE"



Bryant No. 5262

Bryant No. 5261

WITH NEW BRYANT 3 WIRE GROUNDING CONNECTING DEVICES (15 Amperes, 125 Volts)

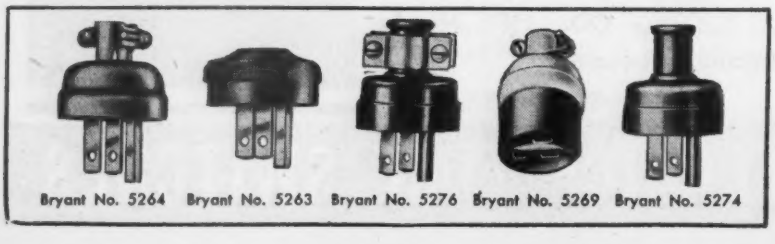
Now, in addition to the 5262 three wire duplex grounding outlet—designed for grounding exposed metal parts of portable appliances—Bryant presents several new devices to round out the line.

Bryant three wire caps are now available in bakelite and rubber with or without cord grips. The grounding blade of these caps is of special design and cannot engage the current carrying contacts, and being longer, completes grounding before the current carrying blades make contact.
(Bryant Nos. 5263, 5263-I, 5264, 5265, 5274, 5276).

The Brown Bakelite, Armored Cord Grip, 3 wire cord connector bodies for extension cords are now available.
(Bryant Nos. 5269, 5270).

A single outlet (Bryant No. 5261) has also been added to the line, and this device, together with the duplex outlet, can be furnished mounted on 4" metal box covers (5281—5282).

J-99829



Bryant No. 5264 Bryant No. 5263 Bryant No. 5276 Bryant No. 5269 Bryant No. 5274

BRYANT
SUPERIOR WIRING DEVICES

Listed as Standard by Underwriters' Laboratories, Inc.

THE BRYANT ELECTRIC COMPANY
Bridgeport 2, Connecticut
CHICAGO • LOS ANGELES

SPECIFY BRYANT DEVICES FROM YOUR ELECTRICAL WHOLESALER

Answered by
F. N. M. SQUIRES
Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.

and

GLENN ROWELL
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

Questions on the Code

Wiring for Ranges

Q. *Recently we have had several of the new type double oven ranges to install. These ranges have a connected load of 16.3 kw. at 230 volts. Please advise whether we should use wire and fuse size according to "connected load" or to "demand load"; also your recommendations on sizes of fuses and conductor for installation of these ranges,*—L.McK.

A. In determining the size of wire to use for electric ranges, Table 29 may be used. For wiring of a single range of 16.3 kw., the following computation may be used:

For the first 12 kw., the demand is 8 kw.

For the excess over 12 kw. which in this case is 4.3 kw. at 5% of this 4.3 kw. or 2.15 kw. plus the 8 kw., gives a total of 10.15 kw. Dividing 10.15 by 230 volts will give approximately 45 amperes.

Such a range therefore may be wired with No. 6 Type R wire or No. 8 RH wire and fused at 50 amperes.

Where more than one range is to be connected on the same fixture, the demand factors in column A of Table 29 apply, using Note 1 below it.—F.N.M.S.

Service Entrance Cable

Q. *Is it possible to use ordinary service entrance cable for feeder runs from the service switch to the distribution panels on the first and second floors of a four family flat?*—C.B.

A. Yes, if all conductors are of the insulated type. This is covered by Section 3382 of the National Electrical Code which reads as follows: "Approved service entrance cables (types SE and ASE) may be used in the interior wiring systems if all the conductors of the cable are of the rubber covered or thermoplastic type; but if without individual insulation on the grounded conductor, may be used only for the range and domestic water heater circuits, or as feeders from a master service cabinet to supply other buildings if the following conditions are met.

(a) The cable has a final nonmetallic outer covering.
(b) The supply is alternating current not exceeding 150 volts to ground.
(c) No domestic water heater is supplied through a conductor without individual insulation."

Service entrance cable containing one bare conductor may be used within a building if the uninsulated conductor is used only as grounding conductor. The Code limits the use of the uninsulated conductor within such a cable as a neutral conductor to circuits supplying electric ranges or other buildings.—G.R.

Grounding Bushings With EMT

Q. *Are ground bushings required when EMT (thinwall conduit) is used for a service the same as would be required in connection with heavy wall conduit?*—L.C.

A. Yes. In Section 2591 the words "service raceways", "all service equipment enclosures", "any conduit of armor" includes electric metallic tubing.—F.N.M.S.

Substation

Q. *I am figuring a new substation for a large grain terminal elevator and propose to construct a detached substation to house the transformers, metering equipment and the oil filled disconnects. Now must this building be constructed of masonry as a regular transformer vault, or may I use a less expensive type of building? The elevator is of wood construction and if destroyed by fire will probably not be replaced. Hence the owners desire to use the cheapest possible type of enclosing structure to house the substation.*—A.M.K.

A. Transformers may be installed in a building of any type construction provided neither the building nor its contents presents a fire hazard to other buildings or property and provided the building is used only in supplying electric service and is accessible only to qualified persons. The N. E. Code requirements for transformer vault construction are intended only for those instances where it is necessary to locate oil filled transformers within buildings other than substations.

Therefore if your substation is of combustible construction, it will be necessary for you and the inspector having jurisdiction to determine the distance it must be from the elevator. This distance should be dependent upon the size of the substation structure, amount of oil in the transformers and disconnects, the slope of the ground, and availability of public fire protection.—G.R.

Grounding Conductors In Non-Metallic-Sheathed Cable

Q. *When using the type of non-metallic sheathed cable which has a separate grounding conductor, not insulated, but running in the sheath, how is this grounding conductor to be connected to metallic outlet boxes or cutout cabinets?*—W. P.

A. It must first be understood that this bare wire is, as stated in the question, a separate grounding conductor and is not to be used as a neutral or grounded conductor.

The simplest way is to bend this bare grounding conductor back along the cable in such a way that it will be in contact with the cable clamp, which secures the cable to the box. It should be made sure that a good electrical connection is made between this wire and the clamp, thereby effectually grounding the box.—F.N.M.S.

ENTIRELY NEW...
COMPLETELY DIFFERENT!

Thunderbolt
HAMMER BIT

CARBIDE TIPPED

GUARANTEED TO CUT DRILLING COSTS

Users report that their costs for drilling in granite and hard concrete have been cut 85% or more with the new THUNDERBOLT HAMMER BIT (Carbide Tipped).

Hundreds of holes can be drilled quickly, cleanly and accurately before the THUNDERBOLT has to be re-sharpened.

The THUNDERBOLT was specifically designed for use in either electric or pneumatic chipping hammers and easily outperforms all other similar products by a wide margin. Dealer inquiries invited.

NOTE THIS UNPRECEDENTED OFFER!

1. Order one THUNDERBOLT HAMMER BIT, any size ⅛" to 1" diameter.
2. Specify make and size of electric or pneumatic chipping hammer.
3. THUNDERBOLT bit and chuck you specify will be shipped and invoiced on open account, at prices below.
4. If THUNDERBOLT has not reduced your drilling costs in 30 days, return bit, chuck and invoice to us.

FILL OUT AND MAIL TODAY!

NEW ENGLAND CARBIDE TOOL CO.
CAMBRIDGE 39, MASSACHUSETTS

Please send us one New England Carbide THUNDERBOLT bit and suitable chuck as specified below, with the understanding that if, at the end of 30 days it does not reduce our drilling costs in hard concrete or granite, we are to return the drill, chuck and invoice

SPECIFY MAKE AND SIZE OF ELECTRIC OR PNEUMATIC CHIP HAMMER.												
CHECK (√) BIT DIAMETER	3/16"	¼"	5/16"	⅜"	7/16"	½"	9/16"	⅝"	¾"	⅞"	1"	
BIT LENGTH	3½"	4"	4"	4"	6"	6"	6"	6"	6"	6"	6"	
PRICE OF SINGLE BIT	$4.90	$4.90	$5.35	$5.85	$6.95	$7.95	$8.50	$8.85	$12.75	$14.50	$16.80	
PRICE OF SINGLE CHUCK	NO. 2 TAPER			$5.25		NO. 3 TAPER			$5.95			
TOTAL PRICE	$10.15	$10.15	$10.60	$11.10	$12.20	$13.90	$14.45	$14.80	$18.70	$20.45	$22.75	

COMPANY

ADDRESS

SIGNED TITLE

A81

Grounding Fixtures

Q. *In residential wiring with non-metallic sheathed cable and using porcelain 4 inch lampholders on outlet boxes, is any grounding necessary?*—W.P.

A. While the question in your letter is given as pertaining to the grounding of porcelain fixtures, it would seem that inasmuch as there is nothing to ground on a porcelain lampholder such as is described by you, the real question here is relative to the grounding of a metallic outlet box used on non-metallic sheathed cable and to which the porcelain lampholder is attached.

Section 3704 of the National Electrical Code required the grounding of metallic outlet boxes used with non-metallic sheathed cable which are mounted on metal lath ceilings or walls, unless they are insulated from such metal. Then, also, Section 2542 requires that metal boxes, if installed in such a way as to be exposed to contact and are on a wet location or within reach of a person who can make contact with any grounded surface or object or when standing on the ground, shall be grounded. Where fixtures or other metal such as boxes, etc. on non-metallic wiring jobs are to be grounded, they must not be grounded to the neutral circuit wire but may be grounded to a separate grounding conductor run in the cable or not within it or may be grounded to the nearest water pipe (if the water pipe is effectively grounded). A solid connection should be used for this.—F.N.M.S.

Grounding of Neutral

Q. *Please explain why the code calls for the neutral bus in a service main, range and light circuit cutout panel (entrance switch) to be grounded and in a distribution panel other than at the entrance, it must be insulated?*—F.J.K.

A. It is required that the neutral wire of an incoming a-c service be grounded at the entrance switch. It is not permissable to ground a neutral elsewhere within the building. Under certain conditions electric ranges may be grounded to the neutral wire of the range circuit. It is not permissible to ground the neutral at the lighting circuit cutout panel unless this panel is incorporated in the service equipment. The reason for this rule is to prevent return currents from returning over other pathways than the grounded conductor.—F.N.M.S.

Motor Disconnect and Controller

Q. *According to Rule 4409 a disconnect switch would not have to be provided in sight from the controller when capable of being locked in the open position. This would take in all safety switches, would it not? Does this disconnect or controller have to be in sight of the motor if capable of being locked in the off position?* —L.C.

A. Section 4409 requires that the disconnecting means for a motor shall be located within sight of the controller location or be arranged to lock in the open or off position. This does not state anything about its being within sight of or from the motor.

Section 4386 requires that a motor and its driven machinery be within sight from the controller location, unless the controller or its disconnecting switch is capable of being locked in the open or off position or unless there is a manually operable switch which will prevent the starting of the motor, within sight from the motor location. All of the above rules, would be satisfied if the disconnect or controller is capable of being locked in the open position when out of sight of the motor. —F.N.M.S.

Service Conductors

Q. *On farm properties is it necessary to run No. 8 or larger conductors for service to each building? There are on nearly every farm small buildings which may not contain more than several lampholders and possibly a convenience outlet or two, and it seems unnecessary to use No. 8 copper when No. 12 or even No. 14 would be adequate as far as load is concerned. Often several small buildings are found adjacent to a larger one which can be used as a point of distribution.—*

A. Section 2304 of the N. E. Code provides permission to use service conductors smaller than No. 8 for buildings containing a single lighting circuit or less but such conductors cannot be smaller than No. 12. However, in many instances such services need not be considered as services but as feeders, as conductors that are protected by proper overcurrent protection at their source of supply may be considered as a feeder and not as service. In the case of overhead conductors; however, one must consider the span which often makes the use of larger conductors necessary. For both

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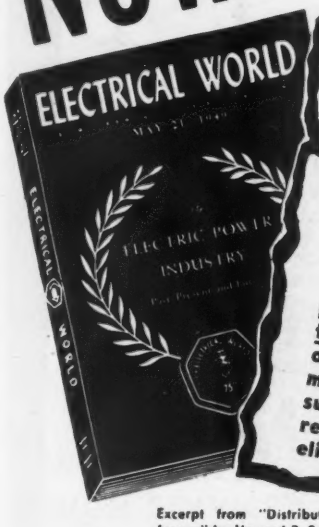


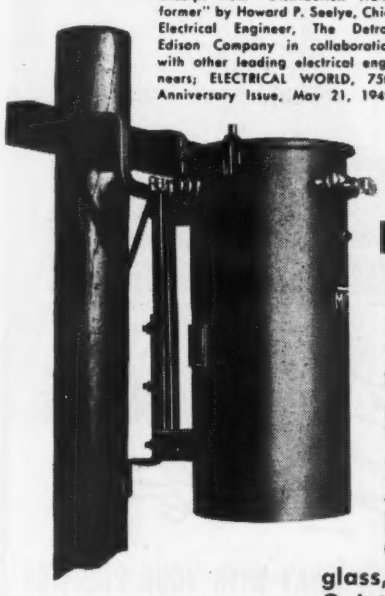
...and lowering costs.

FUTURE POSSIBILITIES

. . . It is to be expected that such activity (improvements) will continue in the future. Much of it can probably not be foreseen at this time. There are a few items, however, which might be mentioned as either distinct possibilities or highly desirable.

There is considerable promise of the production of a dry-type distribution transformer for pole top installation. The advantage will be less weight and lower maintenance. It seems possible that on such a transformer the case might be reduced to a minimum or perhaps be eliminated entirely.

Excerpt from "Distribution transformer" by Howard P. Seelye, Chief Electrical Engineer, The Detroit Edison Company in collaboration with other leading electrical engineers; ELECTRICAL WORLD, 75th Anniversary Issue, May 21, 1949.



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TO: DESIGN, CONSTRUCTION, MAINTENANCE DEPTS.

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RHG

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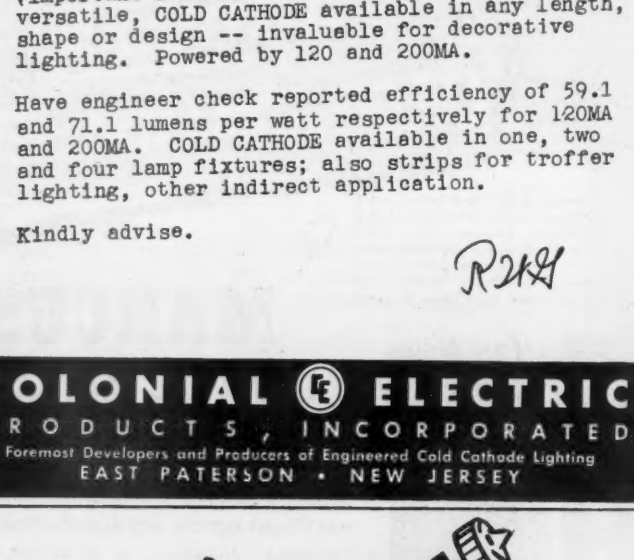

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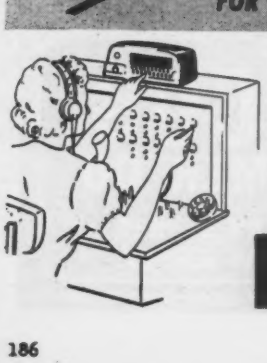

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underground and overhead feeders or service, voltage drop must be given careful study as this is a serious problem on many farm installations. Then the inadequacy of the installation is too often neglected. Too many contractors let the farmer decide what he wants in the way of outlets. Most farmers have given little thought to the possible use they may make of electrical energy and as a result the contractor actually is obligated to attempt to sell adequacy and not outlets as he will be the one blamed by the farmer who buys some appliance which cannot be used without a rewiring job.

I therefore caution you against using small conductors to most of the smaller buildings. They may only want a light or two now but six months or two years from now they will want to run a corn elevator or heat the chicken's drinking fountains or do one or more of a hundred different tasks which can be performed electrically.—G.R.

Water Heater

Q. *Is it permissible to use 12/3 S. E. cable for a water heater installation, providing its amperage doesn't exceed 20 amp.?*—B. H.

A. Yes, provided the so-called uninsulated wire is not used as a circuit wire and the system is a-c at not over 150 volts to ground.—F. N. M. S.

OFFICIAL INTERPRETATIONS.

Section 1118. Interpretation No. 322. Issued March 29, 1949. Splice Insulation.

QUESTION: What significance should be given to the word "equal" as used in section 1118?

ANSWER: A covering protecting a splice or joint need only provide insulation on the conductor to the same extent that the original insulation is a safeguard against the effects of voltage, temperature, moisture, etc.

Section 6262a and 6262b. Interpretation No. 323. Issued March 29, 1949. Elevator Control Panels.

STATEMENT: A single elevator machine is installed in a pent house above the shaft and is mounted upon a concrete floor slab cutting off the pent house from the shaft except for the cable slot. A controller is mounted on the machine above the motor and the motor generator The clearances around the control panel are in no case less than specified in sub-paragraph (2) and (b) of section 6262. Access

to the rear of the control panel may be had from the pent house floor or by standing upon the elevator machine at the rear of the panel. (A conventional arrangement).

QUESTION: Is it the intent of the fine print note, paragraph b of section 6262 to require an insulated platform over the machine upon which a person may stand when working on the rear of the controller?

ANSWER: No.

Section 5142d. Interpretation No. 324. Issued April 29, 1949. Conductors Supplying Gasoline Pumps.

QUESTION: Is it the intent of the National Electrical Code that insulations of Type RW, T, and TW wires (without lead sheaths) be recognized for special circumstances described in paragraph d of Section 5142 of the 1947 edition of the National Electrical Code?

ANSWER: No.

Section 2403a. Interpretation No. 325. Issued April 18, 1949. Fuses.

QUESTION: Are 250 volt cartridge fuses and fuseholder permitted for 440 volt three phase circuits on a star connected system with a grounded neutral or a potential to ground of 250 to 225 volts?

ANSWER: No.

Section 3482. Interpretation No. 326. Issued April 18, 1949. Electrical Metallic Tubing.

QUESTION: With reference to section 3482 of the 1947 edition of the National Electrical Code, would the placing of Electrical Metallic Tubing under a wire mesh reinforcing prior to the pouring of a concrete floor slab be a prohibited installation?

ANSWER: No, provided the installers and inspection authorities are assured the tubing will not be damaged through construction operations.

Section 3382. Interpretation No. 328. Issued April 28, 1949. Use Service Entrance Cable.

QUESTION: Does section 3382 permit the use of service entrance cables (Types SE and ASE), with two insulated and one bare conductor in the cable assemblies, as the feeder in an interior wiring system to a load center that does not supply or control other buildings of the property?

ANSWER: No.

Section 7031. Interpretation No. 329. Issued April 28, 1949. Circuit Breakers in Emergency Lighting Systems.

QUESTION: Does section 7031 of the 1947 edition of the National Electrical Code forbid the use of branch circuit circuit breakers instead of fuses in the branch circuits of emergency lighting systems protected as specified in sections 7041 and 7042?

ANSWER: No.

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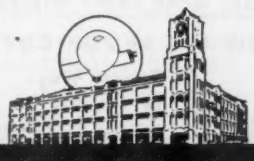

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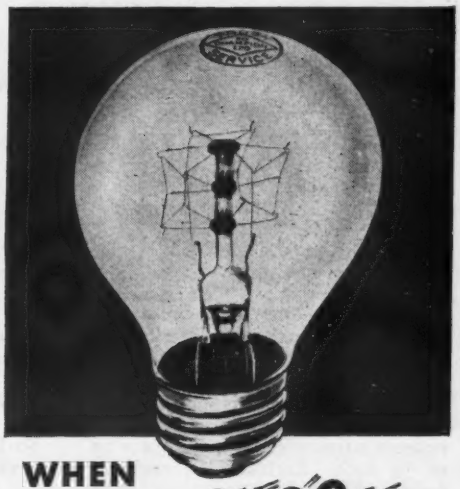

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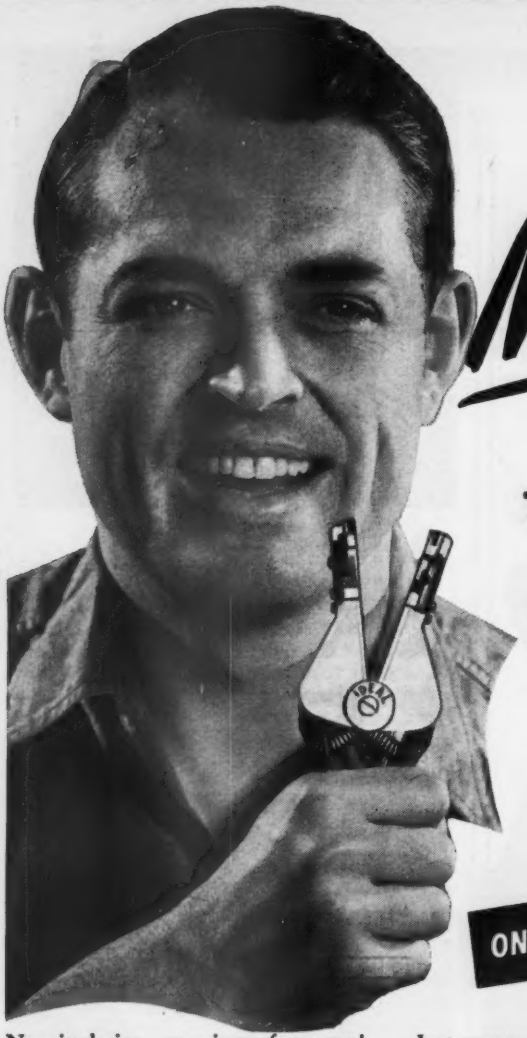

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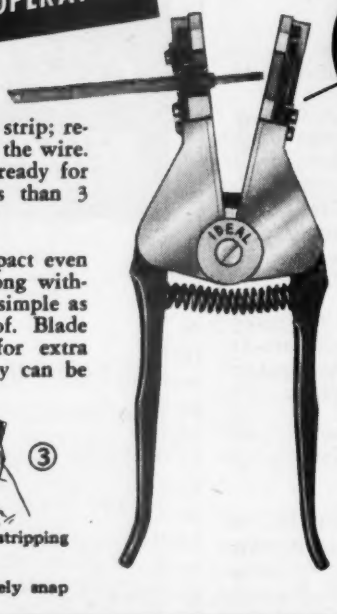

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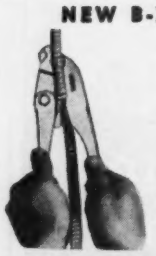

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Reader's Quiz

Locating Grounds

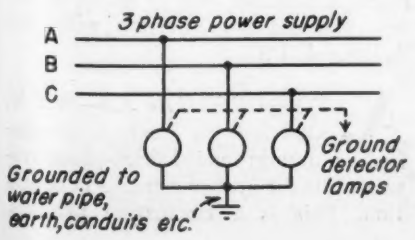
QUESTION 323—Our plant distributes power at 440 volts by means of 3 conductor varnished cable, both exposed and in conduit. The nature of the operation is such that when grounds occur we cannot shut the equipment down to trace them. It is necessary to leave them on the line until another one occurs on another phase. Naturally, this sometimes means a severe and expensive blow-up with subsequent expense. Is there any way that we can locate these grounds while the equipment is still running?—W.P.R.

A. TO QUESTION 323 — It would be better to use a set of ground detector lamps and shut your circuits off for only a few seconds, whenever a ground occurs, rather than let two grounds occur and have to shut down for hours resulting from the short.

Ground detector lamps can be mounted on the main switchboard or a portable set can be made up. The lamps, which should be at least one-half the voltage of the circuit and as low a wattage as possible, are connected in such a way that when there are not any grounds, the lamps will burn at the same brilliancy.

By referring to diagram, if a ground should occur on phase wire A that lamp which is connected to that wire will grow dim or possibly go completely dark. The other two lamps will brighten up considerably.

Grounds can be located very easily by shutting off the circuits, one at a time for only a few seconds, and noticing the lamps return to their normal brilliancy. Then by shutting off individual motors, appliances, etc., the ground may be located very quickly.



Tone-test instruments are available which will accurately locate a ground. Possibly they would not be advisable in your case as cables and conduits are probably run in inaccessible places. —T.F.W.

A. TO QUESTION 323—This problem is always present wherever power is distributed and can usually be solved by the exercise of a little ingenuity in taking advantage of the existing conditions. No information is given on the scope of the installation involved, so it will be necessary to generalize. One extreme would be where a great number of small motors were involved, the other, where only a few large motors were involved. As a 440 v. system is specified, it is unlikely that many of the motors are over 100 h.p. Very few operating conditions preclude the practicability, at some period of the day or week, of opening a motor circuit for the one second required to note the effect on the ground detector. If two sources of power are present, it may be possible to locate a ground by transferring blocks of load from one bus section to another. Individual runs of cable from switch to motor may be readily bypassed by a length of suitable portable cable while the regular cable is disconnected at each end. When the defective cable has been located this method provides for continuity of operation while the defective cable is repaired or replaced. This method, however, will fail to show up a ground in the motor or its leads. Another approach is to take a careful current measurement at the bus end of each feeder, on the grounded phase, immediately before, and after, one of the ungrounded phases has been connected through an impedance of 50 to 100 ohms to ground. The exact value of the impedance should depend on the magnitude of the ground current necessary to be readily noticed when superimposed on the load current of the circuit being tested. It is very desirable that the ground current used for testing be kept at as low a value as is practical to make the test. In the case of a 50 hp. motor drawing about 65 amperes, an increase of 5 to 10 amperes of ground current supplied through the impedance immediately becomes apparent. A switch should be provided to cut the test impedance in and out as required, and one set up will answer for testing any feeder on the system. If a suitable transformer is available, or can be rented or borrowed, an isolated source of power can readily be supplied to the load side of any feeder switch while the switch is opened and the ground detector observed. It is strongly recommended however, that a special effort be made to locate the first ground by a momentary interruption of one circuit at a time at some unobjectionable time. Commence with the least critical circuits, it can easily be done in one second with a little practice and coordination.—R.J.

A. TO QUESTION 323—Nearly every plant has a method of indicating a ground being present on their distribution system, but it is another matter to attempt to locate this undesirable condition without shutting down vital circuit. This has long been my trouble, it being impossible to isolate a grounded feeder or circuit because of equipment on the lines which must be kept operating.

My method of locating a ground while equipment is operating is to transmit a higher frequency impulse signal over the power line and then tracing this signal to locate the ground. There are two methods of producing this signal, namely by use of a motor-generator set, or by electronic means using an oscillator. Not having a high frequency set and having electronic parts available, I used the electronic method. However, either way should prove satisfactory.

For transmission of signal, I constructed an audio oscillator producing 1000 cycles, which was coupled to the grounded conductor and to earth. The output was interrupted by a motor-driven keying arrangement, to make the signal easier to identify.

To trace the signal, I constructed an audio amplifier, as compact as possible, using miniature tubes and using bat-

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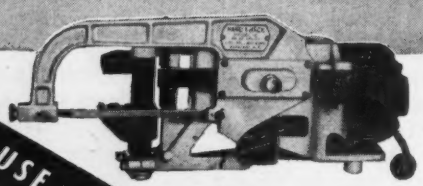

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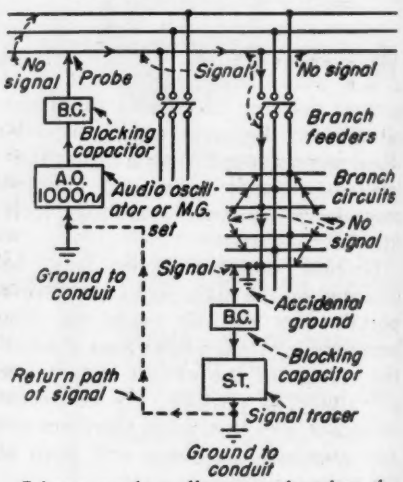
teries for operation to eliminate the inconvenience of a-c supply. These signal tracers may also be purchased from several of the radio test equipment manufacturers.

In use, the transmitter is connected to the grounded power line through a blocking capacitor, and the other side to the conduit system (earth). This sends out a signal consisting of interrupted pulses of 1000 cycles, which will travel only on the grounded line to the point where the ground exists, then returns through the conduit to the point of origin.

If a probe, isolated from the tracer by means of a blocking capacitor, is touched to the power lines, this interrupted high pitch tone will be heard, only on the grounded conductor. It is a simple matter to start at the point of main distribution, and find the branch feeder at fault, then find the circuit at fault, and finally the individual machine or equipment which is grounded.

As the noise level in my plant is high, I use a pair of earphones to make it easier to hear the signal. I also first used a continuous tone, but found that an interrupted tone was easier to detect.

Distribution System



I have made a diagram showing the method described. However, a word of caution is necessary. Do not use a frequency which might interfere with any operations of the power utility. To illustrate, we had to keep clear of 480 and 960 cycles as our utility uses these frequencies to switch street lights on and off. Some utilities may use other frequencies for automatic control.

It was found that 1000 cycles produced a pleasant tone to which to listen, and did not interfere with any utility.—E.J.S.

A. TO QUESTION 323—W.P.R. asks how to locate a ground-fault in an ungrounded three-phase system while the system remains in operation. This is a fascinating problem.

No solution has come to the knowledge of the writer. However, he suggests th following scheme which he tried, successfully, on a model set-up in the laboratory.

Insert between grounded phase and ground, an audio-frequency voltage, and trace the resulting sound with search coil and headphones along the faulty conductor. Provide the insertion through a coupling condenser. It will essentially block the 60 cycles to ground but will offer a much smaller impedance for an audio-frequency current (1/20 for 1200 cps).

Suppose we have a 440 volts 60 cycles ungrounded delta system with a ground-fault in phase 3, and the problem is to locate it. Connect a signal generator through the coupling condenser between point 3-and ground. The condenser should be rated for the sum of 60-cycle plus audio-frequency voltage. Capacity is preferably one microfarad or more. The search-coil should be iron-free, of 2000 to 10,000 turns of fine wire. If necessary, an amplifier may be inserted between search-coil and headphones. Beyond the fault the tone in the phone decreases markedly, and at the fault proper, the tone is zero.—L.F.R.

Change-Over

QUESTION 324 — Recently we changed a 230 volt d-c metal furnace consisting of 125 kw. units to 3 phase 208 volt service. Before disconnecting the d-c, we took a current reading of 235 amps. for total load of furnace.

It is our desire to keep in use the 230 volt units on the 208 volt system for the present, but we want to maintain as near the same conditions as prevailed before the change. We realize we will have to add another unit or more due to the voltage drop but how can we determine just how much current the total load is at 208 volt?

The a-c current readings are as follows: Phase A = 118 amps., Phase B = 125 amps — Phase C = 130 amps. While the 12 units are balanced 4 on each phase, the unbalance as shown above may be due to the fact that the units are not all of the same make and the characteristics may vary. We are not concerned with this, but would like to know the total current now consumed if it is possible to do this on 3 phase. Perhaps we should take a reading of each circuit and add the 12 readings. —W.H.M.

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802-146

Silicone News

DC SILICONES

Silicone Insulation Gives 200 Times Class "A" Life in Tread Cutter Motors

Lake Shore Tire and Rubber Specifies Silicone Insulation for Critical Motors

Case histories from all fields of industry prove that Dow Corning Silicone (Class "H") insulation pays remarkable dividends. The initial cost of rewinding a motor with Silicone Insulation is about twice the cost of a conventional rewind job but Silicone Insulation lasts 10 to 200 times as long. The increase in production that comes of continuous operation is a bonus paid by Dow Corning Silicones.

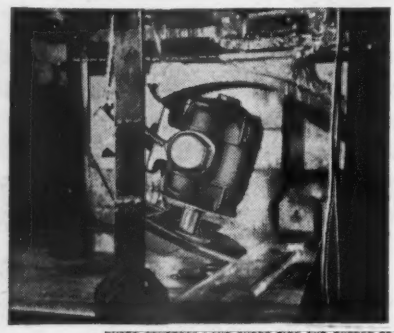

PHOTO COURTESY LAKE SHORE TIRE AND RUBBER CO.

Rapidly reversing tread cutter motors rewound with Dow Corning Silicone Insulation have more than 200 times the life of Class "A" motors.

At Lake Shore Tire and Rubber Company of Des Moines, Iowa, open type 2 h.p. motors are used to drive disc cutters that scarf cut tread stock into lengths. These motors reverse 12 times per minute and operate in a mist of the water used to lubricate the cutters. Life of Class "A" motors in this service ranged from 4 days to a few weeks. Production suffered and maintenance costs were abnormally high.

Lake Shore's electrical maintenance engineers had these motors rewound with Silicone Insulation over 2 years ago. They have already given as much as 200 times the service life of Class "A" motors. This proof of Silicone economy convinced Lake Shore engineers that DC Silicone insulated motors should be used in other essential production equipment such as McNeil Vulcanizers and Banner Bias Cutters.

Here, as in any production plant, Dow Corning Silicone Electrical Insulation greatly increases the life and reliability of hard working motors and motors on which production schedules depend. For more case histories write for pamphlet G7K4.

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A. TO QUESTION 324—In making calculations from the information given I believe there is a simple solution to this problem. Since it has been determined that these heating elements have varying characteristics, the hot resistance of each can not accurately be calculated, but it seems reasonable to calcualte the hot resistance of the total load. If we assume the rating to be 60 kw. at 230 volts, then the hot resistance is 0.882 ohms. With a current of 235 amperes, the voltage at the load must have been 207 volts. Therefore, if the heating elements are connected in delta to a 208 volt three phase line, and it is possible to maintain 208 volts at the load the same heating effect will be experienced as before. Under balanced load, the current in each three phase line will be 136 amperes. A little experimenting will probably show that the heating elements can be connected to give very nearly a balanced load. —T.O.B.

A. TO QUESTION 324—From the values stated in the question, the rating of the 12 heating units would total 60 kw. At rated voltage on d-c., this would account for 261 amperes. If the observed value of 235 amperes is correct, it would indicate that the actual voltage applied to the units was approximately 208, instead of the rated 230, and that the input would be just under 49 kw.—provided we neglect any possible modifying effect due to the operation of the units at a temperature below rating. On a three phase circuit with 208 volts between phases, and a balance of 49 kw. the current in each line would be 136 amperes. If a balanced voltage of 208 is maintained on all three phases under load conditions, the readings given would indicate a load of 44.6 kw. Note that in the foregoing discussion it has been assumed that the furnace load has no reactance, and is operating at unity factor. If this is the case, and a voltage reading is taken on each phase at the load terminals in conjunction with the current readings, the load may be computed. However, the use of a wattmeter is much the preferred method. Refer to article by A. F. Stilson on page 70 of E. C. & M., October 1948 issue.—R.J.

A. TO QUESTION 324—The average of the ampere readings in the three phase circuit is 124.

124 times 1.73 is 215, the equivalent single phase amperes, the total current supplied by the three phase circuit.

208 times 215 equals 45 kw., now being supplied by the three phase circuit. The heaters are considered as non-inductive.

The d-c kw. formerly supplied was 230 times 235 or 54 kw.

54 minus 45 equals 9 kw. to be supplied to equal the d-c kw. formerly supplied. Since each unit consumes 4.5 kw. two units should be added.—B.A.S.

Can you ANSWER these QUESTIONS

QUESTION D15—I have a problem concerning a 2 hp. Delco motor connected to a water pump that constantly burns out the connecting wires on the starting brushes. The motor has a conventional disconnect switch with two 30 amp. fuses, a motor control with rated heater coils and is wired automatically on a pressure switch. I have used No. 10 BX cable and wired it for 220 volts a-c current from main panelboard. We do not have any voltage drop. The motor starts without any apparent overload and operates perfectly normal as long as it is attended. However, it cannot be left alone for more than 18 hours, for then it burns out the connecting wire on the starting brushes. I replace the brushes or make a temporary connection across the brushes and it starts without any trouble. It never blows out fuses or throws out the motor control. Can you explain or suggest a remedy?—G.M.D.

QUESTION E15—We received a call that they were having troube with a slip ring motor at certain steps on secondary controller below full speed, at full speed the needle on ammeter on primary side would stand quite still, but when it was stepped down to a lower speed there would be quite a fluctuation, and when brought to full speed it would disappear.

Our man reports there is no ground, no broken grids and have found no loose connections, though we at first thought this was the trouble. What is the reason for this connection?—C.J.O.

QUESTION F15—We have a number of 2300 volt, 3 phase, 60 cycle oil circuit breakers tapped off a common main bus. These breakers are close and tripped by a 125 volt d-c circuit, fed by a nickle-iron battery. Since we have been adding breakers the question arises as to the capacity of the battery, and means of protection. I would like to know how the size of the battery is determined. Since this d-c is required to trip a breaker in clearing an a-c fault, continuity of d-c service is mandatory. What is the accepted practice in protecting the battery against faults in the d-c circuit?—W.E.T.

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